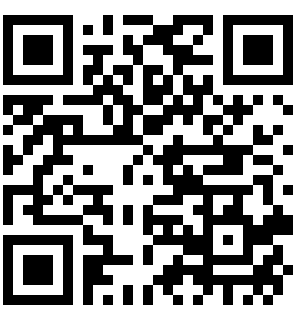

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# Geology, Meteorology & Ethnology of MEGHALAYA

BY

THOMAS OLDHAM, A.M., F.R.S., G.S., &c.,

SUPERINTENDENT OF THE GEOLOGICAL SURVEY OF INDIA.

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# CONTENTS.

# PRELIMINARY REMARKS.

THE following brief sketch of the geological structure of a portion of the Khasi Hills, on the North-Eastern frontier of Bengal, is the result of observations made during two short visits to those hills, in the wet seasons of 1851 and of 1852.

Shortly after my arrival in this country, in the commencement of the year 1851, finding that it would be impossible at that season of the year, to commence field operations in the plains of Bengal, I proceeded, with the sanction of the Government of Bengal, to the station of Cherra Poonjee, with a view to examine the mode of occurrence, extent, and character of the iron ores, which had for many years been known to have been worked in these hills. I arrived at Cherra Poonjee in the middle of the month of June, and left again in the beginning of November. During that season, I visited some of the principal washings for the iron ore, traced out some of the coal beds, and examined and reported on the coal pits at Lakadong in the Jynteah hills. Advantage was also taken of the few fine days which occurred to make a careful survey of a part of these hills, extending Northwards from the station nearly to the Kalapani; and also of the station itself.

It will be seen from the Appendix (B), that during the five-months' duration of my visit in that year, 1851, there fell at Cherra Poonjee nearly 400 inches of rain, and there were only 63 days on which the amount was less than one inch: during this small number of working days, and having no Assistants, I was unable to accomplish very much.

Returning to the same hills, during the rainy season of 1852, I was enabled by the zealous aid of my Assistants Mr. Medlicott and Mr. St. George, to complete the survey of the hills, commenced by myself during the preceding season, from the station across to Nungklow. The large Map accompanying this Report, on a scale of one mile = one inch, is the result of these combined labours; and will, I believe, be found both in the amount and accuracy of its details, fully equal to any Maps of Indian territory hitherto published. The small outline Map, of a larger area, is the result of flying sketch surveys made by myself during trips across the hills to Lakadong, Nonkradem, &c.

During this second visit, I crossed the hills to Nonkradem, and examined the rocks in that vicinity, and from that to the plains at Lacat; and succeeded in obtaining a tolerable series of the organic remains from the limestone and sandstone of Cherra and its neighbourhood.

The season of 1852 was much drier and finer than that of 1851, and we were thus enabled to continue actively engaged in the field, until the very day before leaving the hills. On reaching the plains, we immediately proceeded to the field again, so that the results of our labours were unavoidably put aside until the return of the hot season of the present year, 1853, enabled me to devote some time to their collation. Since leaving the field in April last, the survey of the Khasi hills has been plotted, and the Maps accompanying this report completed, together with a plan, on a larger scale, of the station of Cherra Poonjee itself.

The want in this country of books of reference, or collections for comparison, has compelled me, after a preliminary examination, to submit a selection of the fossils collected, for careful examination and description in England: and, until the final results of such comparison may be known, any report on the district must unavoidably be very incomplete. It will, nevertheless, be in all probability sufficient to make known the principal facts in the physical structure of these hills, and to indicate some of the more important economical considerations springing from this structure.

It is to me a source of great regret, that owing to the season of the year during which I visited these hills, I was unable to examine the lower parts of the ridge, or to proceed along the base, where many points of great geological interest still await solution. Densely covered as these portions are with close grass jungle, abounding in swamps, a sojourn there during the wet and hot months of summer, would be almost certain death to an European: and I was therefore obliged to forego my desire of visiting these districts. It will be seen that in consequence several questions of interest have been left still unsolved.

In judging of the extent of our labours, not only must such circumstance of locality be taken into the estimate, but the state of the climate also. During such wet seasons not much out of door work could be accomplished, especially when the country had to be surveyed and mapped topographically as well as examined geologically. And even during the season of 1852, which, as has been mentioned, was drier and finer than that of 1851, much interruption to such pursuits was unavoidable, where the fall of rain during the *three* months of our visit was not less than 276 inches.(*a*)

Appended to the outline of the Geology, is a brief sketch of the economical applications of some of the mineral products of these hills. And in the appendices which follow, will be found the results of observations carried on simultaneously with the geological researches; and relating to the elevation and climate of the station of Cherra Poonjee, and to the language and etymological relations of the Khasis.

I have to express the great obligations I am under to Colonel Lister, Political Agent for the Khasi hills, and to his Assistant, Lieutenant Cave, for their valuable and ready co-operation in every way to facilitate my enquiries. To

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(*a*) During these three months, the actual number of days during which no rain fell at Cherra Poonjee, was 21: *viz.*, in July 3; in August 6; in September 12; while of days on which the fall was trifling or less than one inch of rain there were 25: *viz.*, in July 3; in August 12; in September 10, giving a total number of fair working days, inclusive of Sundays, of 46.

Mr. Cave also and to Mr. Raban, Adjutant Sylhet Light Infantry, I am indebted for their delightful and instructive company during several trips among the hills, which enhanced my enjoyment most materially; and, which, from my almost total want of acquaintance with the language of the country (at least during my first visit) proved essentially valuable. Indeed, without the benefit of their local knowledge, my success would have been much more limited than it was.

Fig. I

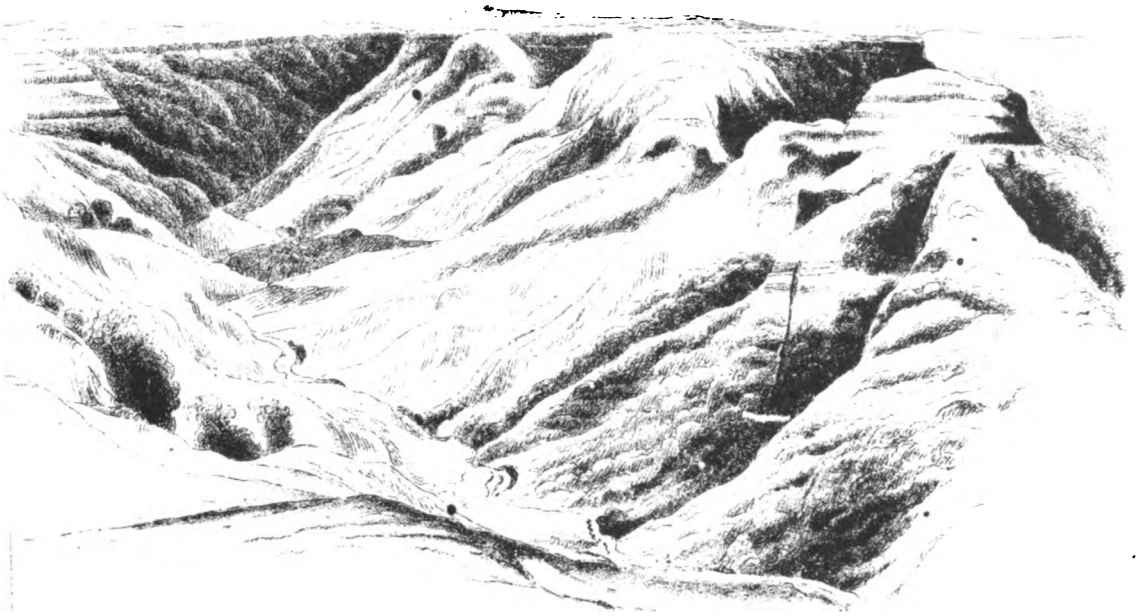
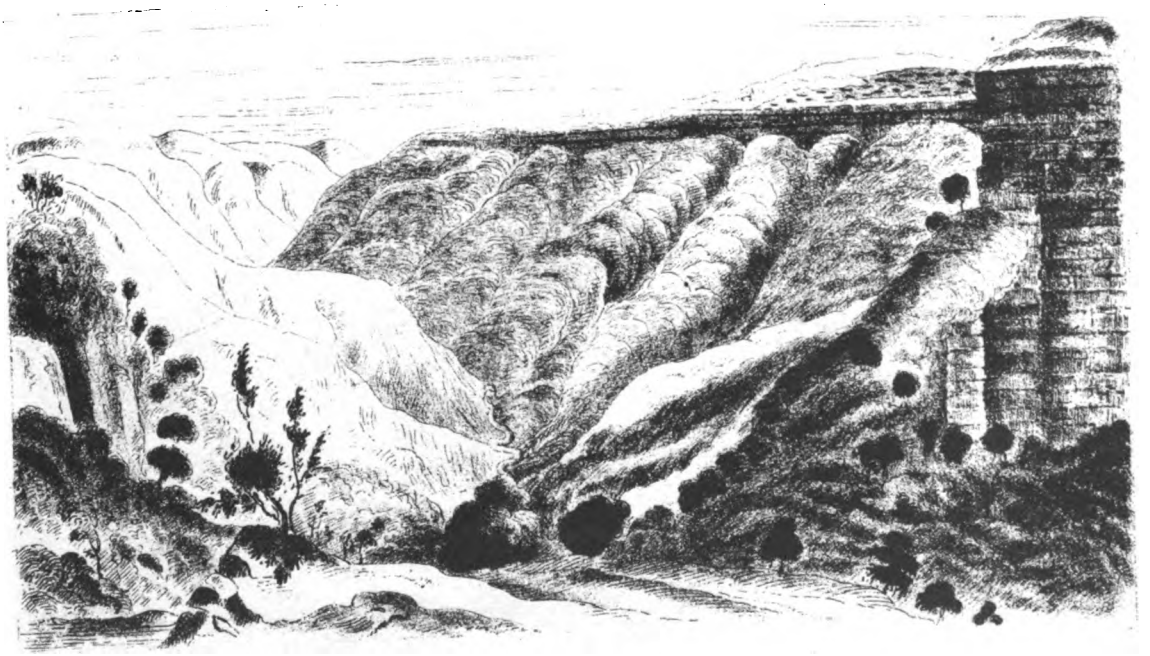


Fig. II



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ON THE

# GEOLOGICAL STRUCTURE

OF THE

# KHASI HILLS.

## GENERAL FEATURES OF THE HILLS.

THE station of Cherra Poonjee,(a) is situated near the Southern crest of an extensive range of tolerably flat-topped hills, which rise suddenly from the plains of Sylhet, and stretch in a direction nearly due East and West, and almost continuously from the valley of the Brahmaputra on the West to Munnipoor and into the Burman empire on the East. This range is, on three sides, surrounded by a great extent of flat country, but slightly elevated above the sea. On the North, it is separated from the Bhotan Mountains, by the great valley of the river Brahmaputra, and the territories of Assam. On the South, the extensive plains of Sylhet intervene between it and the Tipperah hills; while on the West, the valley of the Ganges and the level districts of Mymensing, Rajshye and Moorshedabad, separate it from the Rajmahal hills.

Seen from the plains to the South, this range of hills presents rather a tameness of feature. It has a remarkably regular and flat outline, few points overtopping the general ridge, and few deep glens or valleys breaking the crest.

(a) Cherra Poonjee is approximately in latitude 25° 16′ 35″ North; and longitude 91° 43′ 55″ East.—(*Thuillier and Smyth's Manual of Surveying for India*, 1852.)

The Western extremity of this ridge is known by the general name of the Garrow or Garo hills, being inhabited by the half-civilized tribe of that name. A large portion of their territory is said to be overrun by dense and almost impenetrable jungle. They hold little intercourse with adjoining tribes, are reported to be very treacherous, and excepting along the outskirts of the ridge, are but little known. The Eastern boundary of the Garo territory is but ill defined, but may rudely be said to correspond to the 91st degree of Eastern longitude.

Adjoining the Garos, on the East, is the territory of the *Khasis*, (Kasiyas, Khasias, or Cossias.) It stretches East and West about one degree of longitude, and in the North and South direction, from the plain of Sylhet to that of Assam.

Still further East, and joining the Khasi territory, are the Jynteah hills, which have passed into the hands of the British Government in India, having been forfeited by the Jynteah Rajah in 1835.

To the East of the Jynteah hills, are the tribes of Cachar, the Nagas, &c., which inhabit the country from the Jynteah boundary Eastwards to Munnipoor. Their geographical limits are very little known.

My own observations were confined to the Khasi territory, and indeed only to a portion of it, with a rapid examination of parts of the Jynteah hills.

In this portion of the range, the hills rise very suddenly and abruptly from the plains. At a short distance from their base, and stretching along nearly parallel to the great range, though with interruptions, is a broken series of small rounded hillocks, often beautifully wooded. These rise from 1 to 300 feet above the general level of the plains, and are composed of layers of sand, clay and gravel, very irregularly disposed, and often highly indurated by a ferruginous cement.*(a)* They occur at various distances from the base of the

*(a)* The pretty station of Sylhet is built among these hillocks; and they are also well seen at and near Chattuc. On the summits of one of these knolls is placed Mr. Inglis' bungalow, and on an adjoining one the monument to the memory of the late George Inglis, Esq., "for many years Judge of Sylhet," which forms a conspicuous landmark for a great distance around.

hills, between which and these small knolls, there is generally a flat space, densely covered with jungle, and abounding in swamps, thickly clothed with tall reeds and grasses. Behind this swampy tract, rises the great range of the hills, by a rapidly inclined slope, closely wooded and surmounted by a deep precipitous face, which form a marked feature in the landscape. The crest of this precipice attains an elevation of about 3,500 feet, and above this long and nearly horizontal line, the hills rise gradually with undulating and irregular slopes to the average height of 5,000 to 5,400 feet, with a few summits of still greater elevation, but none much exceeding 6,000 feet. The entire slope of the hills up to the base of the precipitous portion, is thickly clothed with wood, among which a few patches here and there have been cleared for cultivation.

Again, on the Northern side of this range, the country suddenly drops, at Nungklow, to the level of the Boripani river, or more than 2,000 feet, and then gradually dies away into the valley of the Brahmaputra, by a succession of sharply undulating hills and ridges, which stretch from this Boripani river, immediately under Nungklow, to near Gowhatty, in Assam. The whole of these districts forming the descent from the comparatively flat-table land of the top of the ridge; (and which, on the South, extend for about six miles, and on the North for about twenty) is densely wooded, while the upper and more level parts of the hills are clear, free from jungle, and, where the surface is not actual rock, thickly carpeted with grass. The same fact is observable in the many deep glens and water-courses, which penetrate the hills on either flank; the sides of these glens being almost invariably thickly and beautifully clothed with wood, which ceases abruptly at the top, as if cut off with the axe along the crest of the glen; the want of protection from the prevailing winds, as well as the character of the soil, entirely preventing the growth of any timber.

On the southern flank of the range, within the Khasi territory, the many streams which drain the ridge, and carry off the enormous fall of rain that annually takes place here, flow in deep, and large glens, which stretch into the hills for many miles, and add greatly to the variety and beauty of the scenery. Most of these glens are very deeply excavated, the bottoms, or river beds, even at the distance of several miles from the outskirts of the hills, being some

thousand feet below the general level of the top of the range. In outline, all these river gorges, or glens, are remarkably alike; the upper portion of their sides being nearly perpendicular, and precipitous faces of rock, which rest upon a rapidly inclined talus, dropping down to the level of the water beneath. Of this general character, depending as we shall have to remark on the geological structure of the district, a good instance may be seen in the accompanying view of the glen to the North and East of Surareem, as seen from the South. (Fig 1.)

Situated immediately to the West of one of these great glens, and almost overhanging its precipitous sides, is the station of Cherra Poonjee, at an elevation above the sea of 4,120 feet, while the bottom of the glen adjoining is nearly 3,000 feet below. The sanitarium occupies a small level plateau, of a rudely triangular shape, bounded on the East and North-East(*a*) by this deep glen; on the South by the equally grand glen of Musmai; while on the West, the small ridge in which the coal mines are situated, rises with a sharp bluff some 300 feet above the level of the plateau, and is continued on the North-West by the rounded sandstone hills, on the tops and slopes of which the native village of Cherra Poonjee is placed. To the North, the hills rise gradually until the average level of the central portion of the range is attained; from which the view(*b*) looking South, ranges over the flat of Cherra, to the immense expanse of the plains of Sylhet, and to the distant outline of the Tipperah hills, which bound the horizon. (Fig 2.)

The same general physical features are continued Northwards from Cherra Poonjee to Mowphlang (Moflong), 18 miles distant; the hills presenting an almost uninterrupted, and nearly level top, broken only by the deep and narrow river gorges, which intersect it, and which form the peculiar feature of the scenery.

Further to the East, and extending into the Jynteah hills, the same general character continues along the Southern flank of the range; the deep

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(*a*) See accompanying Plan.

(*b*) For the originals of this sketch, and of figs. 3 and 6, I am indebted to Lieutenant Cave, Assistant Political Agent.

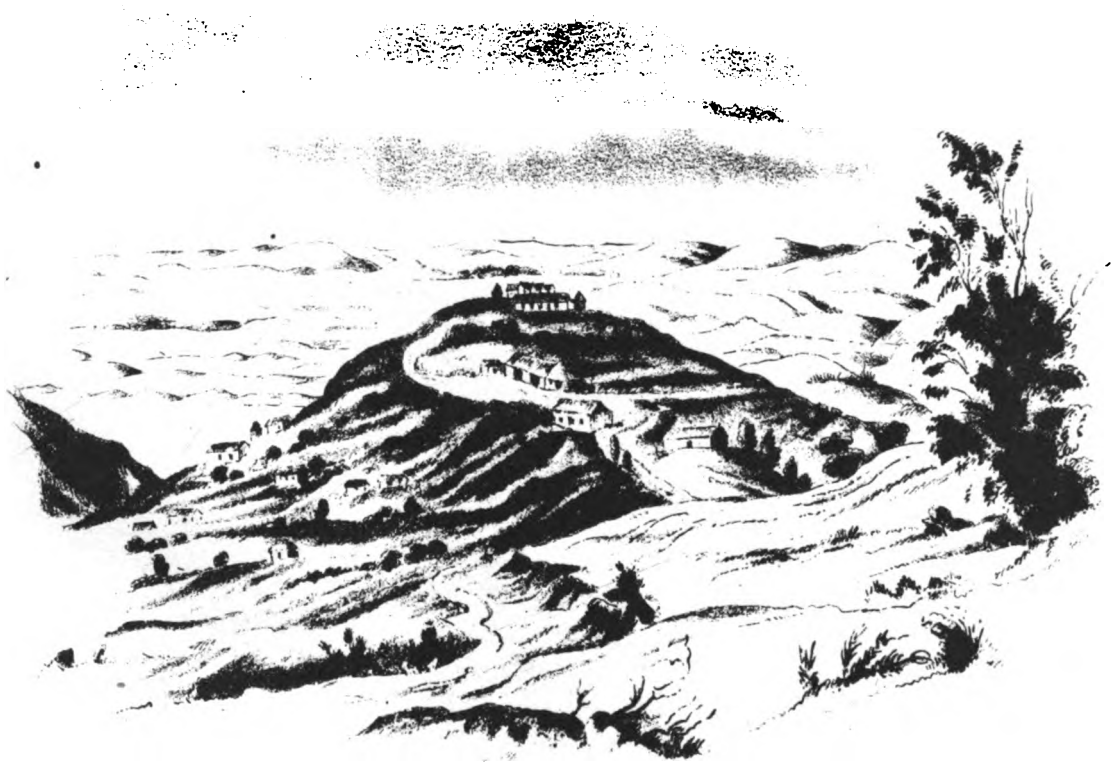

Fig. VI.

valleys East of the flat-topped ridge on which Nonkradem is placed, being exactly similar in outline, and general feature, to those around Cherra Poonjee.

Contrasting very strongly with this general character of the Southern portion of this range of hills, the surface of the Northern portion presents a remarkably wavy and gently undulating outline. This character extends from the neighbourhood of Mowphlang to Nungklow, and may be well seen near to, and North of, the village of Myrung,*(a)* (Fig. 4) or, looking Southwards from Nungklow, (Fig. 5) towards the Kullong rock. River valleys diversify the surface of this wavy plan, but they are of very different character from those to the South. More open and spreading, they offer none of those precipitous cliffs so common around Cherra Poonjee, and are by no means so deeply excavated. Waterfalls also are numerous, but they partake more of the character of "forces" and rapids, than the remarkable falls which rush over the precipitous cliffs to the South, and which are so well seen in the valleys of (Fig. 6) Mawsmai, and Mawm'luh, near to Cherra, and some of which in the height and unbroken character of the fall are unequalled in the world.

This general character of the surface continues to the Northern edge of the range, where at Nungklow, the hills drops suddenly, and almost precipitously to the level of the Boripani river.*(b)*

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*(a)* The buildings on the rising ground in the centre of the view, are the guard-house and outpost of the Sylhet Light Infantry at Myrung: while the larger house, a little below, is one of the staging bungalows on the road to Assam, a part of which road is seen in the foreground. The houses of the small Native village of Myrung are on the slope of the hill. The indistinct outline of the snowy peaks of the Himalaya may be traced to the left of the sketch.

*(b)* Close to the Suspension Bridge, across which the road to Assam is carried over this river, there is a beautiful waterfall. It cannot be compared as to height of fall with those near to Cherra, the whole fall, which is broken into two leaps, not being more than 150 feet. But in the force, and massiveness of the stream, the bold dashing of the waters, the richly wooded and varied outline of the hills around, and the absence of any feeling of tameness, such as always impresses the spectator in the horizontal and repeated lines of fall in those around Cherra Poonjee, this fall is, I think, superior to any other I have seen in the Khasi Hills. It is wilder, freer and nobler.

There is a tolerably continuous and level ridge, stretching East and West, nearly in the parallel of Mowphlang, and extending towards Nurtiung. Through this ridge pass the deep gorges of the river Oomgot and its feeders. Still further to the East and South, the valley of the Mentedoo is bounded by the comparatively level country extending Southwards towards Lakadong, where we again meet a precipitous flank of the hills, dropping down to Burghat, and thence continued by outlying minor ridges of sandstone and limestone into the flat country of Jynteahpoor.

Coincidently with this remarkable alteration in the general features of the hills, is an equally remarkable change in their geological structure; the whole of the Northern portion of the hills, from the parallel of Mowphlang, (with the exception of a few isolated patches to which we shall hereafter refer) being composed of granites and of metamorphic rocks, presenting on the whole a gneissose character, with a few intercalated beds of slates and quartz rock, and dykes of greenstone; the bedded rocks occurring at every angle of inclination and being much disturbed. The Southern portion, on the other hand, is composed of sandstones and limestones with associated beds of coal and shale, which, as a whole, rest horizontally on the older rocks.

In addition to these, basaltic and greenstone-like volcanic rocks are well exposed in some places. These are of still more recent age than the sandstones with which they occur.

After this very brief sketch of the general aspect and structure of the hills, it remains to describe a little more in detail the various rocks which occur in the district examined, and their mutual relations. Taking these in the order of their relative epochs, the azoic metamorphic rocks demand the first place. Of the igneous rocks, which have so materially modified the aspect, position and structure of these mechanical deposits, we shall speak afterwards.

*Metamorphic rocks.*—(Gneiss, micaceous slates, clay slates, hornblendic slates, quartz rocks, &c.) A very large area in the Khasi hills is composed of

slaty and gneissose rocks, presenting for the most part a highly crystalline character, and traversed throughout their entire extent, by numerous veins of granite, and here and there by dykes, and bursts of greenstone. With slight interruption, these rocks stretch from the most Westernly portion of the hills, which I have examined, to the most Easterly. They occur at Nungklow, on the Northern verge of the hills immediately over the valley of Assam, and here form the entire flank of the hills down to the Boripani river: from Nungklow, they extend South to the Kullong rock, (where a great mass of granite has burst through them,) and from thence to near Mowphlang, where they become covered up by the sandstones. They seem to wind round the Northern flanks of Shillong hill, and stretch thence by Pomrong, to Coote, Mooshai and Suneassa ; and into the Jynteah hills.

Throughout this area, they maintain, on the whole, a tolerably constant character ; they are greatly contorted in every direction, these contortions affecting every variety of rock. In the midst of so much disturbance it is difficult to say that the rocks have any prevailing direction or dip, although they appear to have a tendency to great rolls ; the inclination of the sides of these curves trending to the North and South, or to a little West of North and East of South.

In the immediate vicinity of Cherra Poonjee, these rocks are well seen in the deep glens which surround the station, and from the lower parts of which the thick covering of the more-recent sandstones has been denuded. In Cherra valley, we find in the bed of the Temshung river, alternating beds of quartzose slates, quartz-rock, and gneiss, dipping at very high angles, and much disturbed. They form in many places bold cliffs along the banks of the stream. Associated with these and traversing them in veins, is a fine-grained granite of nearly homogeneous texture, itself cut up by numerous veins of a coarsely crystalline and highly felspathic perphyritic granite. These veins are of all sizes, and some of them are in too great mass to be looked upon as mere cotemporaneous veins, or segregated masses, but look like the results of a second intrusion of molten rock into the fissures of the previously indurated mass. Others are small and ramifying, and consist chiefly of largely crystalline felspar, of a

deep and beautiful flesh-red colour, and of black mica; the latter occasionally in crystals measuring an inch across.

With the gneissose and slaty beds, we find associated, occasional layers of hornblendic rocks. The same series continues without intermission up to the base of the conglomerates, which, on the flanks of the glen, rest nearly horizontally on these rocks.

Passing Northwards from Cherra Poonjee, these old rocks are concealed by the sandstone, until they are again exposed on the Northern side of the deep glen close to, and North of, Mowphlang, across which the road to Assam passes. Here the rocks are blue and grey flaky slates, associated with quartzose, and micaceous layers, dipping at high angles, and with tolerable continuity to the North and West. Some of the beds near to this are smooth-grained gritty clay slates, of a greenish-blue colour, and flaky. In one or two places attempts have been made to extract slates for roofing purposes from these beds. In these rocks, however, there has been no " cleavage" structure superinduced, and the surfaces of the original lamination of the rock, which are the only surfaces along which it can be separated, are too uneven and at too irregular intervals, to admit of slates suitable for ordinary purposes, being obtained from them. Heavy coarse flags might be raised here, and these would answer well for the covering of out-offices, sheds, &c.

In this glen, the slate rocks rest immediately upon a great mass of greenstone, (to which we shall refer again,) and at their junction are considerably indurated, and at the same time split up by numerous divisional planes which pass across the laminæ, and break up the mass into small angular pieces. Similar greenstone is seen cutting through the rocks in several places to the North of this, and on the surface is decomposed into a coarse ferruginous, or ochrey mass. The slates continue of the same general character, as far as the remarkable flat, called Lung-king-ting-now. Dropping into this flat from the higher ground to the South, there is a considerable thickness of black earthy slates, with hard gritty quartzose layers, also black in colour. These slates are markedly different from any of the rocks in the vicinity, and are not met with

again in the section. They are probably the uppermost beds of the slaty series met with in this district.

This flat space, nearly half a mile in width, is a remarkable feature in the hills. Greenstone is seen at both sides of the flat space, and appears to form the surface below, but a thick covering of clay conceals all the rocks, while rising up the steep slope on the North towards Sohiong, the same gneissose and highly micaceous rocks, as have been described in the Cherra valley, again appear. These are well seen in the village of Sohiong; they consist of thin bedded gneiss and micaceous slates, with hard gritty quartzose layers, dipping at high angles, or nearly vertical. They are much twisted both in plan and section, but have on the whole a dip to the S. E., at angles varying from 60° to 85°. The old road, which passes close under the rude entrenchments of the village, exposes them well, and they are also seen on the sides of the beautifully wooded glen to the East, on the verge of which the Poonji is built.

Northwards from Sohiong, the same rocks continue, but on the whole they gradually become more crystalline and solid, and the constant recurrence of large blocks of granite points to the existence of many veins, or intruded masses of that rock the boundary and extent of which cannot however be easily traced. Such is the case in the neighbourhood of Nungbree, again near Myrung, and still further to the North, at Nungrumai; (commonly called Normai) but the general surface of the country is composed of these gneissose, and slaty rocks.

The constant occurrence of these masses of granite, and also of minute veins ramifying among the layers of the slates and gneiss, give convincing proof, that the thickness of these rocks is here very slight, and that the great mass of the granite which is well seen at a short distance to the East and West, continues at no great depth below the surface, under the slaty beds. (See Section.)

In the eastern portion of the hills, similar rocks are met with in the valley of the Mentedoo. They occur in thin layers of gneiss and mica slates dipping at high angles (60°—70°) towards the N. and N. E., abounding in small quartz veins, and are much less contorted, than in the western portion of the hills. They

are here capped by horizontal beds of sandstone. The gneissose rocks continue all up the valley of the river, forming the talus or slope of the high ground on either side. At Joowye village, and stretching along the top of the ridge on which it is placed, for some little distance towards the East, a thin capping of horizontal beds of sandstones and conglomerate, forming an outlier of the more extensive beds to the South-East, conceals these rocks, and affords an excellent instance of the total unconformability of the two series.

Under the sandstones are highly micaceous and shining slates, with thick beds of hard gritty micaceous gneiss; numerous veins of quartz occur traversing the rocks, and large veins of granite also pierce them in many places. At Joowye village,(*a*) these slaty beds, dip as a mass, to the S. and S. by E., at angles varying from 45° to 70°.

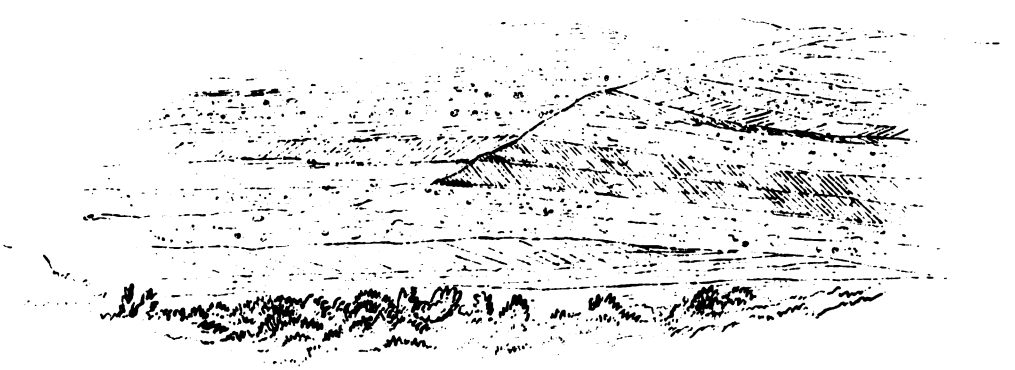
Similar rocks are seen wrapping round the edges of the granite, about four miles East from Coote village; while between this and Pooring, largely crystalline greenstone crosses the valley. At this village itself (Pooring) the rocks are gritty gneiss in thick strong beds.

Dropping thence into the Oomgot valley, we find hard close-grained siliceous slates, and thence towards Pomrong we have gneiss and micaceous slates in thick beds. These alternate continually, and are well seen in some of the river gorges, through which the feeders of the Oomgot pass: veins of quartz abound, and the rocks, although much contorted, have a general inclination to the North-West. Granite veins also occur.

Throughout the series of rocks, which I have just described, few mineral products of any value are found. I have above alluded to the attempts made

(*a*) Joowye is one of the largest villages in these hills. It is beautifully situated on a ridge, overhanging the rich and well cultivated glen of the Mentedoo River. The hill slopes on either side covered with scattered pines and other trees, and the flat holms at the bottom cultivated like a garden, give the place quite an English aspect. In the village itself magnificent groups of bamboos throw a grateful shade over the houses, and large tanks and ponds are formed among the undulating ground. The houses are of a better class, and in many respects assimilate more to those of the Bengalees than among the Khasis proper, while the physiognomy of the people themselves, and their superior stature, seem to confirm the idea of an intermixture of race.

FIG. VIII.



to obtain good roofing-slates, from some of the beds. In a few places, as under Nungklaw, &c., small crystalline grains of magnetic iron abound in some of the beds, precisely of the same character, as that obtained from the granite, and occasionally in greater abundance; but in most of these cases, the additional hardness of the rock would prevent this ore from being extracted with equal economy from the slates, as from the granite.

I have not been able to trace the existence of any organic remains whatever in these rocks. They are, as far as I know, throughout the entire group, truly azoic.

*Sandstone.*—In ascending the Khasi Hills, from Teria-ghat, the rocks met with throughout the greater portion of the rise, are sandstones of varied mineral character. In the lower part, the prevailing colour is a greenish brown; passing on the one hand into a grey, and on the other into a red tint. Occasionally we find beds of a light grey or whitish colour, variegated with red and ferruginous spots or patches, but these are more frequent in the upper portion of the series. Beds of shale and shaly sandstone and clays of yellowish and blackish grey colours, are associated with the sandstones. Several of the beds of sandstone are highly calcareous, and sometimes pass into calcareous grits.

On the upper beds of this series, the station of Cherra Poonjee is placed, and here we find resting conformably upon the sandstone, a series of beds of limestone, coal, and shales, to which we shall refer again.

The sandstone group of rocks, is well exposed in the perpendicular cliffs of the valleys adjoining the station. It is not, however, always easy to obtain means of examining the series satisfactorily. The only paths which pass down the sides of the glens, have naturally been selected where some fallen mass has produced a spur, or slope along which the path can wind, but where the rocks are concealed; while the greater portion of the vertical cliff is inaccessible. Most of the slopes also are clothed with dense forest. It is therefore with some difficulty that the actual succession of the beds is traced out.

Reserving at present all minute details, which will be more appropriate, when the organic contents of these rocks have been fully examined, I shall merely state the general divisions of the group.

At the base, whenever it is clearly seen, and resting quite unconformedly upon the upturned edges of the older rocks, there is a thick mass of coarse conglomerates. The pebbles are chiefly of quartz, both crystalline and granular, all considerably rounded, and of all sizes, from six inches diameter to one inch. Masses double this size are found, but are not common. These are imbedded in a felspathic gritty cement. This conglomerate is well seen in the Cherra valley, and in places it is fully seventy feet thick, forming a very well marked line of cliff along the sides of the glen. On this coarse conglomerate rests a sharp semi-angular grit of a dark brownish colour, varied by numerous light specks. These are scarcely rounded fragments of felspar crystals, of a light flesh-red colour, which give the rock a very peculiar aspect. Locally, these beds become coarser, and pass into a pebbly grit, and in this case, it can occasionally be seen that these imbedded pebbles are partly of granite and not altogether of felspar.(a) With local variation in texture and coarseness, these beds are at least 150 to 200 feet thick.

Over these come sharp grits of reddish-brown and greyish-brown colours. In these are many casts of shells, generally imperfect and fragmentary (cardium, &c.) Higher up the sandstones have a greenish-brown tint, and contain numerous remains of echinodermata. These become calcareous, and then decompose into a brownish-red sandy rock, which on the fresh fracture is a very hard mass a bluish tint. Where the fossils occur in the grits, they are only casts, or the place of the original shell is filled with a soft yellow impalpable clay; where the rock is calcareous, the shells of the echini are replaced by carbonate of lime. It is almost impossible, owing to the nature of the matrix, and to the highly crystalline condition of the carbonate of lime, to obtain good specimens of these. At the base of these fossiliferous beds there are locally developed some beds of a nodular dark grey shaly sandstone (Mahadeo).

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(a) These beds are well seen at the zig-zags, on the road to Teria-ghat from Cherra Poonjee, of which they form a considerable portion.

These beds containing the echini (*Cyrtoma* of McClelland) form a well-marked line along the face of the Cherra Valley, where the beds are calcareous, and are again well seen under Mamluh, where they were first noticed by Dr. McClelland.(*a*) Associated with these echinoderm remains, and occurring also a little below them, are large plicated oysters, (Ostrea, allied to *O. flabellulum*) generally in fragments.

Over this group are numerous beds of soft earthy sandstones, of brownish and red tints, with intercalated beds of clay and thin shales. These continue with little intermission until the flat of Cherra Poonjee is reached, where thick-bedded strong sandstones occur, not very hard, and of a reddish colour. In these beds I have not observed any remains of shells, but impressions of stems of plants, very rudely preserved, and in most cases much too indistinct for identification, are not uncommon.

Over these sandstones, and separated apparently by a thin bed of stiff blue clayey shale, comes the limestone which forms the bluffs of the small detached ridge in which the Coal has been worked to the west of the station of Cherra Poonjee. This limestone is here about 80 feet thick, separated above by eight to ten feet of sandstone and shale from the Coal, which again is covered by alternating beds of soft grits, and clays to the top of the Hill *(see below)*.

The thickness of the entire group, which I have just described, is near to Cherra Poonjee, not less than 2,000 feet. Throughout the whole of this great thickness the beds are entirely conformable, and are very nearly horizontal in position. They are irregularly developed, beds of sandstone and clays often thinning out, within the space of a few hundred yards from some feet to some inches in thickness. Throughout the entire series, also, but more especially in the upper portion, there is a frequent repetition of the most remarkable cases of false bedding and oblique lamination, evidencing a constantly repeated change

(*a*) These beds of sandstone, which being soft and loosely coherent, are readily acted upon, and decompose into a friable sand in which the harder portions of the organic remains continue imbedded, gave rise to the idea, which Dr. McClelland has published, of their forming a sea-beach. The true relations of the beds, or so-called "beach," can be well seen in the adjoining cliffs, where the conformable association of these beds with the other sandstones may be traced.

in the force and direction of the currents, and in the other conditions under which these beds have been deposited. The accompanying sketch shows one, and by no means an extreme instance of this kind. *(Fig.* 8.*)*

The beds are, I have already mentioned, nearly horizontal throughout, but dip slightly, and continuously as a whole towards the South and South by West. This dip is very slight, but is easily traceable when observed over a considerable area. And the same fact is even more markedly seen when the range of the hills is observed from the plains to the South, at sufficient distance to enable the eye to take in a considerable sweep. In the following sketch of these hills, as seen from the River Soorma, near Sonamgunj, the sandstones and associated beds, so well marked all along the range by the steep precipitous cliffs they form, as in the vicinity of Cherra Poonjee, are seen gradually to drop down to the level of the plains, as they pass to the West.*(a)* The occurrence of beds of Coal, which at Cherra Poonjee, are at the top of the hills, nearly at the level of the plains close to Laour, and towards the West (as noticed by several observers), is in some degree a confirmation of this statement. The same fact appears to hold with reference to the sandstone group towards the East also—for we find beds of the same nummulitic limestone, coal, and sandstone, with the same group of beds below them, forming the hills near Lakadong ; and here attaining only an elevation of not more than 2,500 feet, which at Cherra reach 4,500 feet.*(b)*

These sandstones stretch inland from Cherra Poonjee to near Mowphlang, *(see Map)* retaining on the whole their nearly-horizontal arrangement, and presenting throughout the same general lithological character. This horizontality of the beds, and alternating disposition of the shales, grits and coarser sandstones, is well seen in the splendid cliff which bounds the great valley of Cherra to the North. Here also dark earthy grits, with iron pyrites, are seen to alternate with the sandstones. The same series is again seen in the cliffs bounding the valley North of Lairungoo. *(see Fig.* 1.*)* The total thickness

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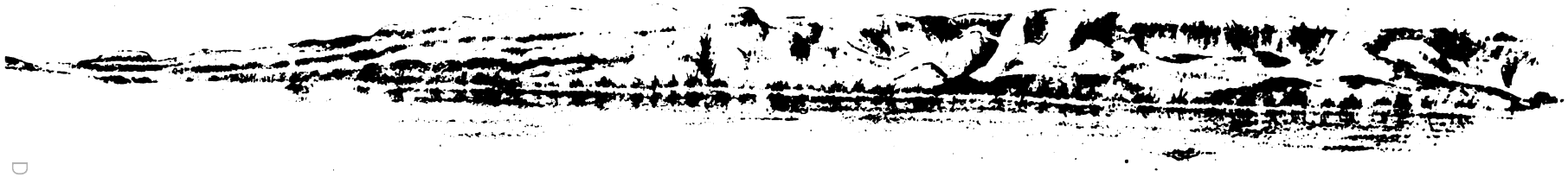
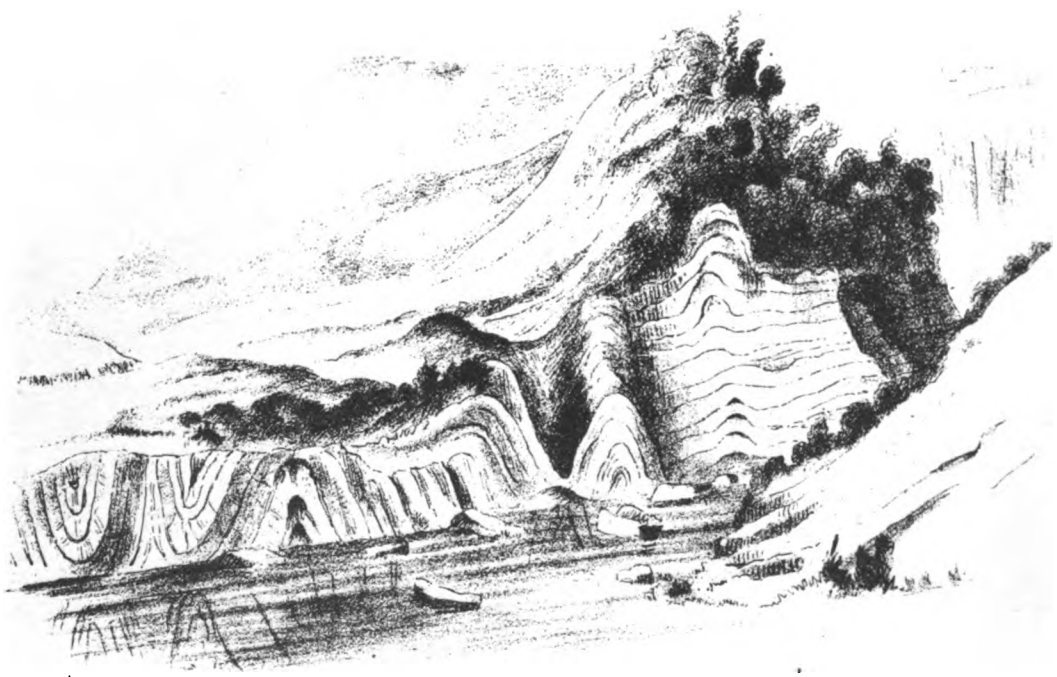
*(a)* The station of Cherra Poonjee is placed on the hills to the extreme right of this Sketch.

*(b)* The thin outlying caps of sandstone at Joowai are, in this part of the hills, analogous to the outliers of Nungbri and Laidom, North of Cherra Poonjee.

Fig. IX.







*Bagapani twisted sand stone beds.*

of the group has, however, considerably diminished here, and the metamorphic rocks come much nearer to the surface. But little change in the mineral structure of the series is traceable. At one or two places along the route, patches of Coal, (of very poor quality however,) occur, associated with the sandstones (as at the Northern end of the Native village of Cherra Poonjee; about half a mile further on and near Surareem,) and occasionally blackish-grey shales, with numerous small fragmentary impressions of carbonized vegetables. At the roadside near the Kala-pani, beds of dark earthy and pyritous sandstones and shales, similar to those near to Cherra Poonjee, occur.

Near to this, the sandstones begin to show the effects of the intrusion of volcanic rocks, (to which we shall refer again), both in their position, and in their texture. Dropping into the valley of the Kala-pani, about half way down the South-Eastern side of the glen, we meet highly crystalline greenstone under and supporting the coarse sandstones. The beds in junction with the greenstone have been greatly altered: the colour has become a deep purple; they are intensely indurated, and are in fact quartz rock. Further, instead of breaking into the laminar and irregular pieces, which these sandstones ordinarily yield, a blow of a hammer fractures the mass into small prismatic blocks, having a semi-columnar structure. The original lines of deposition have, in fact, been obliterated and a new series of divisional planes produced. These planes are perpendicular to the deposition planes of the rock, and have a prevailing direction North-East and South-West, and nearly at right angles to this. The dip is about 25° to South-West.

On the Northern side of this valley, the sandstones again appear, here again nearly horizontal, and forming the steep cliffs along the top of the glen. *(see Sketch Fig.* 10.*)* The road winds up the steep slope of the valley side, and passes through a cleft in these sandstone beds. The greenstone forms the whole of the river bed, and extends up the side of the valley for more than one-half the distance. The lowest beds on the Northern side, are coarse pebbly conglomerates, greatly indurated. Dropping again into the adjoining and parallel little valley, (between the Kala-pani and the Boga-pani,) we lose the sandstones again, and find a continuous sheet of the greenstone forming the

whole of the bottom of the glen. Upon it rest on both sides, the coarse conglomerates and sandstones greatly indurated and disturbed. Thus under the village of Maw-be-lurkar, conglomerate is seen very highly inclined, and greatly indurated. Huge masses of this rock have in other places fallen from their natural position, and threaten to block up the glen.*(a)* Toward the Northern end of this glen, the originally continuous covering of the sandstone has been denuded, so as to leave only a few small outliers resting upon the greenstone, and forming the highest tops about here. Some of these outliers are very small, not more than a few hundred feet square.

Along the line of road, the greenstone continues to show until the valley of the Boga-pani is reached. In the bed, and on the banks of the Wattam, the stream which here joins the Boga-pani, the greenstone is well seen, but close adjoining in the glen of the larger river, there is a magnificent exhibition of the disturbances to which the sandstones have been subjected. The beds are at all angles, vertical and nearly flat, rolled over and bent in the most fantastic forms; several complete arches or folds are seen cut through by the river, and form a series of parallel curvings, which are even more beautifully seen owing to the different tints of the different beds. *(Fig.* 11.*)* These contortions continue though less markedly all along the river valley. The beds of clean grits have been so indurated, as to appear quite glassy and like quartz rock; the grains still appearing distinct. The conglomerate beds also are hard, have a talcose and soapy character, and the shaly-beds are more slaty. Notwithstanding this great amount of change, the same false bedding seen so commonly around Cherra Poonjee, is here observable; and current-marking is well shown on many of the beds, which from mineral texture alone would appear much more nearly allied to the old slates and quartz rocks, we have before described.

Passing up to Mowphlang, these sandstone beds continue exhibiting gradually a less amount of change as they rise upon the hill. These rocks here

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*(a)* This little valley, although in the magnitude and grandeur of its features, greatly inferior to the larger glens close by, is yet one of the most beautiful in the hills, and owes not a little of this beauty to the contrast between the steep cliffs of the sandstone above, with their dark and richly-coloured surfaces, and the steep grassy slopes of the greenstone below. In this valley the edge of the beds of sandstone is remarkably rounded and smoothed, as from the long continued action of water.

Fig: XII.

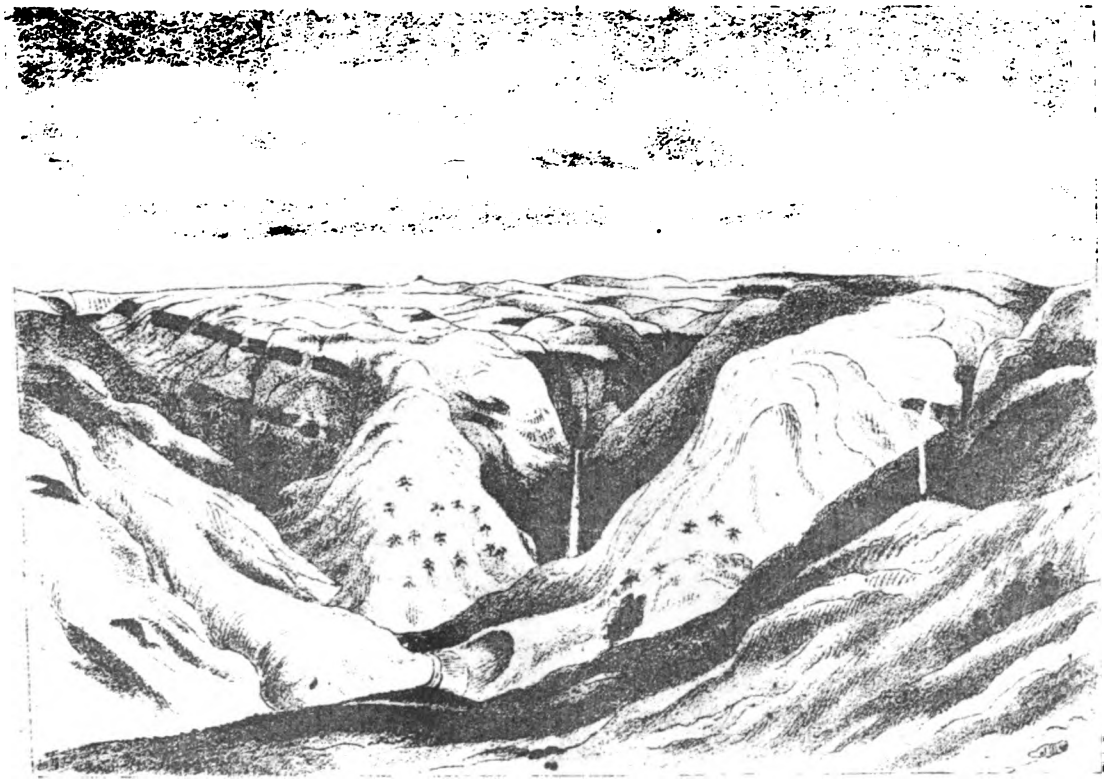

exhibit also a tendency to a cleavage, or division in planes different from the planes of bedding; along these cleavage lines many discolourations have taken place, which give the rocks a much more variegated aspect, and parti-coloured look than they would otherwise have had.

Close to the staging Bungalow at Mowphlang, the same rocks are seen cropping out on the hill side and dipping here at an angle of 75° to the South-East, cleavage planes show here also, and give the rocks a peculiar aspect. The prevailing direction of these planes is East and West, and they are nearly vertical.

The same general dip of the mass of these rocks (to the South-East) with many contortions and twistings, continues all across the country East of the Boga-pani and between Laikro and Uswirr Hill *(see Map)*. forming on the surface an undulating but tolerably level outline, but showing in bold escarpments in some of the river gorges. This is well shown in the upper portion of the valley of the Wattam stream. *(Fig.* 12.*)* A few dykes of the greenstone, which is so largely developed in the lower part of this valley, cut through the sandstones and appear on the surface.

Stretching Northwards from Mowphlang hill the sandstones and associated beds form the level ridge, along which the path to Shillong hill passes. For some distance from Mowphlang the same intensely altered character continues in these rocks, but more Northerly, the beds seem less changed, (as about Sadow village), and forming the top and some distance down the flanks of Shillong hill, we find sandstones scarcely indurated or altered at all. They are fully as soft, as and in other respects very similar to, the Cherra sandstones.*(a)*

I had no opportunity of tracing out the boundary of these sandstones here, or of examining their connection with the granite to the South of the hill.

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*(a)* I have above considered the whole of these rocks as belonging to the same group or formation, as I have seen no good ground for a separation within the limited area I had an opportunity of examining. I should however state that there are several points, both as regards their mineral character and their position, in this portion of the district, that are not very easily explicable. It is not improbable, that there may be here remaining portions of an older group of rocks, but this doubt could only be solved by a careful survey of the country to the West and South from Mowphlang which I was unable to visit.

But one of the most interesting facts in the history of these rocks, is well seen in several places nearer to Mowphlang, and between that village and Mawreng. I allude to the occurrence of veins of granite piercing them. These veins are in places 1 to 2 feet thick, but generally smaller; they bifurcate and pass across the bedding of the rocks, or along the planes of deposition—these planes being much contorted. The veinstone is a highly felspathic, but small crystalline granite; mica black and brilliant; the quartz greyish-white, and the felspar with a slight pinkish tint. This is the only place where I have seen this fact exhibited.

Separated from the sandstones near to Mowphlang, by some miles distance, and forming an isolated cap of very limited area, on the hill close to the village of Nungbri, are some beds of coarse soft grits, of a yellowish-red tint, with finer sandstones and thin earthy layers. The total thickness of these beds is not more than 50 feet. A similar cap of very similar sandstones forms a long, narrow, flat-topped ridge, on which the villages of Mawsutye and Laidom are placed, about three miles North of Myrung. This ridge stretches nearly East and West for about two miles, but with a very irregular outline: and contrasts well with the wavy surface of the adjoining country, by its flat-top and scarped sides, seen best from the North. The extreme thickness of the beds of sandstone here does not exceed 100 feet. No fossils were found in these sandstones, with the exception of a few very imperfect impressions in one of the beds near Nungbri, much too indistinct for identification; but which appeared to be similar to those found in the Cherra Poonjeé beds. They were all vegetable remains. In the absence therefore of any fossil evidence, and arguing only from the mineralogical character of these beds, without the occurrence of any well-marked layer, admitting of identification at distant points, it is impossible to assert, positively, that these sandstones at Nungbri and at Laidom belong unquestionably to the same series as the Cherra Rocks; although I believe such to be the case; and that these caps of sandstone are only the now detached and outlying remnants of a once extensive series. which stretched continuously over these hills, and which has been subsequently denuded. These patches remain as a measure by which we can estimate the amount of matter which has been removed.

Sandstones similar to those occurring near Cherra Poonjee are seen along the Southern flank of the hill range, as far Eastwards as Burr-ghat, and from this they continue still further in the same direction. I have only had an opportunity of visiting these districts to the East during two trips, in one of which I passed up from the plains to Joowai, and in the other went down from the hills by the ridge of Molih, Nonkradem, and Kung-diah, to Lacat. I can therefore only speak of the rocks exhibited in these two sections, although there is no question that the same group of rocks continues all along.

To the North of Nonkradem, the ridge on which that village is situated, is separated from the similar level ground to the North, by a deep transverse glen (seen in foreground of Fig. 3) in which gneissose and slaty rocks are well exposed. Resting nearly horizontally upon these and forming a cap on their up-turned edges, the sandstones stretch almost continuously from this to Lacat. At the northern extremity of this broad flat ridge, where the ground narrows by the approach of the deep valleys on either side, this sheet of sandstone is broken up into several small outlying pieces, separated by slight depressions in the ridge, some of these are not more than 100 yards square. But, proceeding to the South, the sandstones gradually become much thicker and form the entire surface. About Molih they form thick beds of red ferruginous grits alternating with shaly beds and clays. Close to the village to the North, some traces of coaly layers are seen.*(a)*

The same ferruginous sandstones associated with black pyritous shale continue to show along the ridge towards the South. In the sandstone beds, there are frequent nodular concretions, highly ferruginous. The beds continue nearly horizontal, but are occasionally inclined from 15° to 20°. Passing Southward, to a small village called Tung-ji-nath, we find these dark red ferruginous sandstones resting upon other beds of a much lighter tint. Associated with the latter beds there is a bed of good *Coal* about 3 feet 6 inches thick on an average.

*(a)* From large slabs of the thin-bedded sandstones of the neighbourhood, the defences of Molih are built. These slabs are placed on edge and side by side, and form a wall some six feet high. Through this the entrance to the village is by a well-constructed and covered gateway. The whole forms a rude defence, of little value certainly in the modern system of attack, but which would have afforded a great protection against the arrows of any hostile clan.

It is seen in a deep croom or ravine close to the village of **Tung-ji-nath.** The section of the rocks immediately with the Coal, is as follows, in a descending order :

| | ft. | in. |
|---|---|---|
| Hard ferruginous grits above light reddish sandstone, ... | 35 | 0 |
| Dark-coloured shaly sandstone in thin laminæ, ... | 2 | 6 |
| Sandstone, darkish colour, ... ... ... ... | 1 | 0 |
| Dark-coloured shale, thinly laminated, ... | 2 0 to 1 | 6 |
| Coal, ... ... ... ... ... | 4 0 to 3 | 6 |
| Black shale in thin layers, ... ... ... ... | 0 | 6 |
| Soft dark sandstone, micaceous and carbonaceous (thickness not seen). | | |

This Coal seems very similar in quality and character to the Cherra Coal. The bed is partially exposed for about forty feet on the face, and in this short space it varies in thickness from four feet to three feet and a half: and within a few yards of this to the West it has thinned out to one foot and a half. Towards the East, as far as it is seen, it continues of tolerably even thickness: but the natives residing in the village adjoining, say it does not go on. It dips very slightly to the East by North; dense close jungle prevented me from tracing it much further.*(a)*

The hill drops suddenly about 400 feet close to this village on the South, and below this there is an undulated level plateau very similar to that of the Mahadeo, South of Cherra Poonjee. This continues to the River Kowa-i-assa, a short distance North of the village of Kungdiah.*(b)* Sandstones of varied coarseness, with softer and shaly beds between, continue all along until about a mile North of Kungdiah. Beds of soft fossiliferous sandstone, slightly calcareous, appear. The shells are preserved in carbonate of lime, and are well seen from

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*(a)* The cost for posterage from this to Lacat, the nearest mart in the plains, would be as great as for the Cherra Coal to Teria Ghat.

*(b)* Singh Manick, the Kyrim Rajah, generally resides here, in preference to Nonkradem, the principal town of his territories.

the contrast of their white colour with the dark greenish-brown tint of the rock. Traces of coal occur close to Kungdiah.

From this to the plains at Lacat, nothing but sandstones are visible, for the most part ferruginous and gritty; some pebbly conglomerate beds are also seen. In the upper portion of this section, no limestone was seen, corresponding to that at the station of Cherra, nor does it show immediately at *Lacat*, although abundantly worked at a short distance to the West of that place.

Below Lakadong, the same series of rocks is seen: passing from Burr-ghat, where a thick coarse conglomerate is seen, (similar to that at the base of the sandstone group near Cherra) through a series of sandstones of varying mineral character, but markedly similar to the succession at Cherra. The same varieties of organic remains are here found also: and the same beds marked by the presence of plicated oysters (*O.* allied to *flabellulum*) and of echini. These beds occur at about the same distance below the nummulitic limestone, over which the Coal of Lakadong is found. In other respects, also the parallelism of this lower bed of limestone at Lakadong, and of the series of sandstone beds beneath it, with the limestones and underlying sandstones of the Cherra series, appears to be completely established.

I have before alluded to the extension of these sandstone beds towards the North from Lakadong. About 3 miles North from Rombai, (*See Map B*) slaty sandstone and dark carbonaceous shales occur, nearly horizontal. They are well seen in the small rivers or streams. The slaty beds are shining and micaceous. The country about here and towards Rombai *(a)* is chiefly grassy table land, a large proportion of which is under cultivation. The same character, with the interruption of a few rounded dells or glens, continues to near the village of Bappung. These glens have a remarkably regular direction, all bearing nearly due North-East and South-West, the steep scarp of the rocks in all cases facing the North, while the Southern ridge slopes gradually away.

*(a)* About four miles North from Rombai, pines first appear; they become plenty, large and healthy, a little North of Bappung.

North of the village of Bappung, and a very short distance from it, there is a well-marked ridge formed of horizontal beds of sandstone, with a few shaly partings, sometimes dark-coloured, nearly black and carbonaceous, with glistening specks of mica. This ridge has a curiously-rounded outline, and is eaten into regular re-entering angles and bays, like a shore long exposed to the wash of the ocean waves. Not far from Bappung, in a low flat depression to the West and North-West, granite is seen It is largely crystalline and somewhat porphyritic, and in general aspect very similar (though not quite so large in grain) to that near Lailangkot, North of Cherra. Its connexion with the sandstones is not very clearly seen. North of this, the rounded hills are again composed of flat horizontal sandstones occasionally conglomeritic, and frequently presenting fine instances of false-bedding. This is common also in the beds to the South.

Similar sandstones and conglomerates are seen as before noticed, stretching along the top of the hills, bounding the valley of the Mentedoo River, in horizontal beds, resting unconformably on the up-turned and degraded edges of the beds of gneissose slates. (*See Fig.* 7.) The lower beds here are conglomeritic, occasionally coarse; large rounded pebbles of quartz, and *also of the hard gritty gneissose beds below*, being imbedded in a sandstone paste. This character changes to a fine gritty sandstone, formed of sharply angular pebbles of quartz in regular layers. Intercalated with these, are some slaty beds very irregularly developed, occasionally carbonaceous, dark-coloured, and micaceous; occasionally light-coloured, compact and earthy. Deep ferruginous stains are frequent, and the rocks have often, in consequence, a very variegated tint. The beds here are perfectly horizontal.

The country between Nonkradem and Joowye, I had no opportunity of visiting. The same sandstones which we have been describing, evidently continue across, cut into, and denuded by the deep river gorges, where the other and older rocks are exposed. And the same rocks appear also to continue further to the East from Lakadong.

LIMESTONE.—I have already alluded incidentally to the occurrence of limestone near to the station of Cherra Poonjee and elsewhere in the Khasi hills, and in reporting on the Coal beds at Lakadong in the Jynteah hills, the relations of the limestone there to the Coal have been pointed out. But the importance of these limestones, both in a geological and in a practical point of view, calls for a more detailed description.

The limestone is well seen in the small isolated ridge bounding the station of Cherra Poonjee to the South-west. This little ridge rises with a steep and perpendicular escarpment from the level ground of the station. Along its base an irregular talus of fallen masses of both limestone, Coal and sandstone, conceals the actual junction of its lower beds with the sandstone beneath. In one or two points this is indistinctly seen, and a bed of hard blue stiff clay, only a few inches thick, separates the mass of the limestone from the sandstone; on which it rests perfectly conformably; and like it, therefore, nearly horizontal. The thickness of the limestone beds here is at least 75 feet. In the texture and character of the beds slight differences are traceable, but these are not remarkable. As a whole, it is similar, throughout compact, of a grey-blue colour, hard and splintery, with an irregular conchoidal fracture. It is generally thin-bedded, but some of the beds attain a thickness of two and three feet: these thicker masses are, however, frequently divisible into others, the partings being well seen when the rock has been weathered. The uppermost beds are a little more earthy in composition, and between these beds and the mass of thin bedded limestone below, there is locally a thin (from half-an-inch to one-and-half inch) layer of calcareous sandstone interposed. This is not, however, constant. Throughout the whole of these beds fossils are found. In the compact layers, these do not show on the fresh fracture of the stone, the shells or other remains being entirely replaced by the limestone: while in the more earthy beds they become distinct, and easily recognizable. In the lower beds, small, nearly globular echini are abundant, associated with turrited gasteropoda (cerithium, turritella, &c.) occasionally of good size. Above this, small corals with nummulites are more prevalent, while in the upper layers there is a greater variety of shells. Pectens (of small size and invariably in single valves) occur. Turritella, Naticæ,

Patella (?) associated with Nummulites. The latter go through the entire series of beds.

The limestone beds stretch with an irregular outline, but with a similar bluff escarpment throughout, westwards to near the village of Mawm'luh. From this the outcrop turns again eastwards, and passes to near Mawsmai. Along this face, and more especially towards Mawsmai, the limestone cliffs are much less regular, being broken up by numerous fallen masses, which stretch out from the main mass of the rock, and are thrown into the most irregular and fantastic outlines; the beauty of which is greatly increased by the curious shapes into which the mass decomposes; and by the richly-varied tints, which the moss-clothed rocks present. The whole is thickly covered with wood. Again, turning northwards towards Cherra, the mass of the limestone has been denuded along the depression through which the road passes, and is found in a small detached outlier to the East of this.

We shall notice again the direction of some of these cliffs of limestone, and the probable cause of this. Parallel to the principal faces of these escarpments, we find a series of jointing planes, or fissures accompanied by slight disturbances in the position of the beds. Some of these are well seen along the face of the cliffs West of the station; and produce very beautiful pictorial effects, the fern-clad sides of the deep clefts being brought strongly into contrast with the sunless depths of the chink beneath. *(Fig.* 13.*)*

Independently of the unquestioned evidence which these steep escarpments of the limestone afford, of the long continued denuding action along the base of these cliffs totally different from the ordinary causes now in operation to degrade and remove these rocks, there is further proof of their having been subjected to much local excavation by running water in the several large caves which penetrate these rocks; and whose smooth and polished marble-like sides, at once indicate the power which has excavated them. Of these the most remarkable are those near Mawm'luh, and near Mawsmai at opposite sides of the ridge. That these caves or excavations in the limestone were formerly much

DRAWN ON STONE & LITHOGRAPHED AT THE ASIATIC LITH: PRESS. T. BLACK, LITHR: CAL:

more numerous, may also be inferred from the many sudden and sometimes nearly circular depressions which occur in this ridge, and which have obviously been caused by the falling in of the rocks above, into a hollow or excavation below, from which they have subsequently been gradually removed. The same process is still in operation to produce similar effects, though on a minor scale. The waters of the many streams which disappear underground in the adjoining district, are undoubtedly gradually excavating the rocks beneath, and the support being removed from the upper beds these must inevitably fall in, and be themselves gradually removed.*(a)*

Limestone very similar to that which occurs at Cherra Poonjee, is found in large quantity at a much lower elevation on the hill side. At the village of Tungwai (Tingye,) there is a great extent of this rock exposed, and here there are large quarries from which many thousands of maunds of this stone are annually removed. The limestone stretches from this up the hill side for some distance. In general aspect and character it is very similar to the limestone at Cherra, but presents in its lower beds some marked differences.. The occurrence of much larger foraminifera, and of a large natica (?) are among these. This difference is very much less marked at Tungwai, than to the East of the Walingtia River, where there are immense quarries of limestone. Here the larger foraminifera become much more abundant, and are almost the only fossil found in these beds. Above these, in other beds the smaller foraminifera abound and also fossils very similar to those found at Cherra Poonjee. The abundance of some of these small foraminifera, which form nearly the entire mass of some of the beds, give those layers quite an oolitic character, although where the surface is a little weathered, the cause of this structure becomes evident.

I have already described the mode of occurrence of the limestone at Lakadong, it is in every respect similar to that at Cherra Poonjee. At Lakadong however there are two distinct deposits, one occurring under the Coal of that place, and being, I believe, the parallel of the limestone at Cherra, and the other

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*(a)* In several places about here, considerable streams go underground for some distance. The stream seen in *Fig.* 16, passes in this way under the cliff of limestone and coal.

above the Coal, and overlying sandstones. Of the latter deposit, which at Laka dong attains a thickness of at least 50 feet, there appears to be no representative at Cherra Poonjee.

Again, precisely as at Cherra Poonjee, great deposits of a similar nummulitic limestone are found at the base of the hills, so below Lakadong there is a great extent of similar limestone. This is seen on the banks of the Harry River, North of the village of Pichadar Poonjee. The beds here dip at a high angle (55° to 65°) to the South, and support a great thickness of sandstones and shaly beds, which are all conformable to the limestone below.*(a)* To these lower deposits of limestone and their mode of occurrence, we shall again refer.

Reverting to the nummulitic limestones of Cherra, there are some very interesting appearances presented by the upper portion of the deposit. In the mass of the upper beds, (which, as I have mentioned, are more earthy than the lower) there are imbedded several small patches of Coal and coaly mud. The upper surface of the limestone is also very irregular, and here and there filling up the hollows in this wavy surface, and covered by the sandstone, are thin pieces of Coal and coaly shale. In one place the upper beds of the limestone have been removed to the depth of some feet, in the form of a channel or gully, as if by the action of a stream: and this gully has subsequently been filled in with the sand now forming the beds of sandstone overlying the limestone. These deposits of sand, have naturally conformed to the surfaces of the hollow into which they have been carried, but the upper surface of each successive layer has gradually become more and more level, the sand necessarily accumulating in greater mass in the hollows, until, at a distance of about four feet from the general surface of the limestone below, the beds have again become regular and horizontal. This remarkable depression in the limestone, coincides with a crack or joint which passes nearly vertically through all the beds below, but along which there is no dislocation or faulting *(Fig.* 14.*)* That the limestone beds must have been considerably indurated or at least desiccated, previously to this

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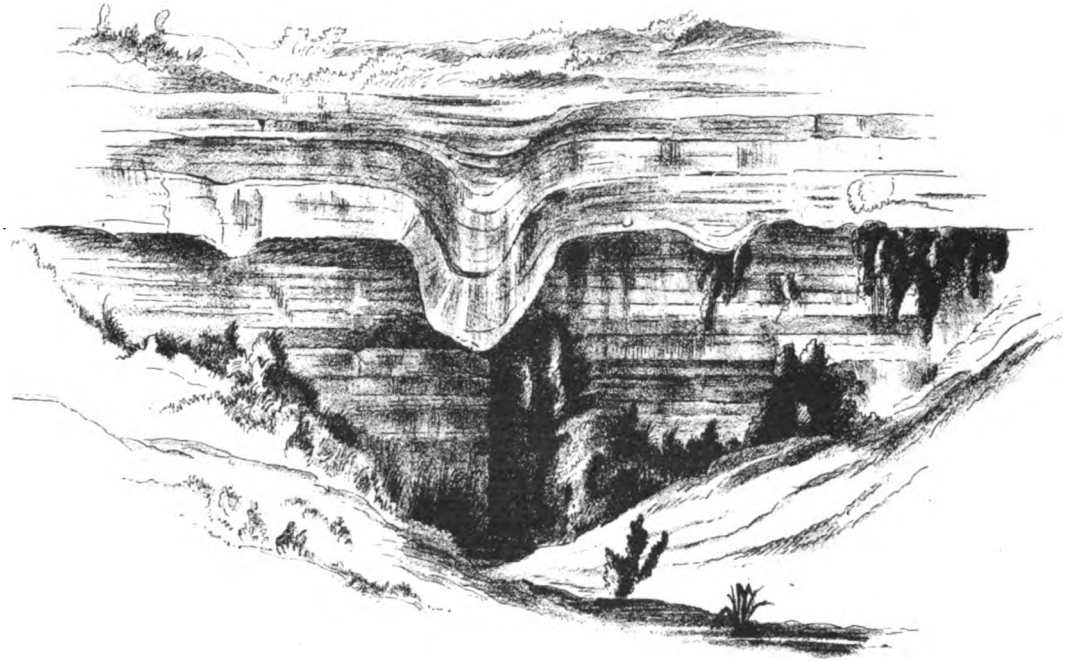
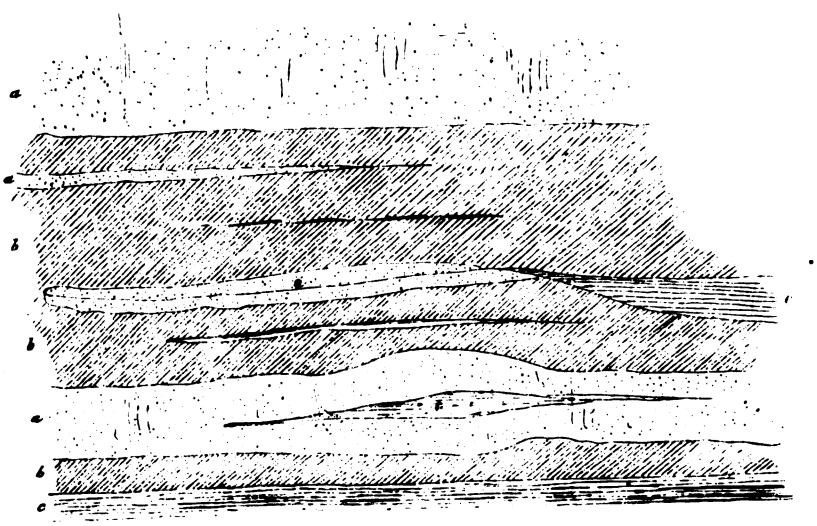
*(a)* Having merely seen these beds in passing up the stream, I cannot enter into any details regarding them.

Fig: XIV.



at Cherra Coal Mines.

Fig: XV.




a a a. Sandstone. b b b. Coal. c. Shale. Sandy.

DRAWN ON STONE & LITHOGRAPHED AT THE ASIATIC LITH PRESS 7 BLACK LYON ST. CAL

excavation taking place, is evident from the sharp and unbroken edges with which the horizontal layers of the limestone come against the sides of the sandstone filling the hollow. No soft mud, such as these limestone beds originally consisted of, could have remained at the steep angle of the sides of this gully. And I think it also evident, from similar reasoning, that the same forces which produced the excavation in the limestone must have continued in operation during a portion at least of the time occupied in the deposition of the sandstones above. The surface of the limestone has been subjected to a wearing action of a similar kind, but in a slighter degree, in several other places closely adjoining, *(see Fig.* 14.) It is therefore clear that while all the organic remains contained in the limestone point to its marine origin, although under no great depth of water, the occurrence of the imbedded patches of Coal in its upper beds, and of the small and isolated pieces of coaly matter filling up the hollows on its surface, and the peculiar way in which it has been excavated as by a running stream, combine to show that it must have been brought to the surface and subjected to sub-aerial forces prior to the deposition of the overlying sandstones.

Coal, &c.—Resting immediately on the limestone which we have just described, there is a group of alternating beds of sandstones, shales and Coal, which form the uppermost beds of the small ridge in which they occur. The section is as follows, under the surface.

| | ft. | in. |
|---|---|---|
| Earthy sandstone beds, covered with jungle, ... ... | 0 | 0 |
| Sandstone slightly tinted red, ... ... ... ... | 6 | 0 |
| Shaly sandstone whitish and grey, ... ... ... ... | 1 | 0 |
| Sandstone earthy and ferruginous, with concretions of iron-stone, ... ... ... ... ... ... ... | 2 | 0 |
| Grit, free and open grained, softer towards top, ... ... | 2 | 6 |
| Sandy shales, thin-bedded, ... ... ... ... ... | 1 | 0 |
| White coloured grit, sharp and angular, no cement, ... | 7 | 0 |
| *Coal*, ... ... ... ... ... ... ... ... | 3 | 0 |
| Shale greyish-black, with fragmentary impressions of vegetable remains, ... ... ... ... ... ... | 1 | 6 |

| | ft. | in. |
|---|---|---|
| Sandstone, hard ferruginous and nodular, ... ... ... | 2 | 0 |
| Sandstone, thin shaly beds with carbonaceous particles, giving a blackish-grey colour to the rock; beds very irregularly developed, ... ... ... ... | 1 0 to 2 | 0 |
| Ferruginous sandstone, ... ... ... ... ... | 3 | 0 |
| Thin-bedded earthy sandstones, .. ... ... | 1 0 to 2 | 0 |
| Sandstone, hard, ferruginous, and earthy, very irregular and varying from ... ... ... .. ... | 3 0 to 6 | 0 |
| Limestone (as described above.) | | |

The Coal seen in the foregoing section becomes in the lower part of the bed very shaly, and passes into the grey shale on which it rests. A little to the South of this section, (which is taken just above the cliff of limestone facing the station of Cherra) this thick bed of Coal, which is here of uniform quality throughout, becomes split up by several small intercalated layers and wedge-shaped masses of sandstone. These gradually increase to the detriment of the Coal, and shortly after the Coal has died out altogether. In the Coal itself iron pyrites occurs disseminated and in crystalline lumps: it is found in all parts of the bed, both near the top and bottom, but chiefly the latter. It is not however very abundant. The accompanying Sketch of a part of the Coal-bed will show its appearance where the intercalated sandstone is partially seen, (*Fig.* 15.) The roof of the Coal is a thick bed of whitish clean grit, composed of sharp angular quartz grains, entirely without any perceptible cement. It is occasionally coloured with deep ferruginous stains.

The whole series of beds is very nearly horizontal, and is sharply scarped on their outcropping edges. The Coal has been extracted by means of adits driven in horizontally on the bed, and the position of the seam has enabled the required drainage of the mines to be effected with very little trouble or expense. The entrances to some of these adits are seen in the accompanying Sketch of a portion of the ridge seen from the North, and which also shows the general position of the mines.

Coal is also seen near to Cherra Poonjee exposed on the road-side at the Northern extremity of the native village; again about half a mile further on traces of Coal are seen, but in both these places it seems too much disturbed and too irregular to be of any value.

Coal again shows further to the North near the little village of Surareem on the road-side, but in very small quantity. This out-crop would seem to be connected with the thick bed which shows under the village of Lairungoo, in the face of the steep glen, towards the East (*see Fig.* 1). Close under the Southern end of the village, this bed of Coal is six feet thick, dipping about four degrees towards the North-West. The seat of the Coal is here dark carbonaceous shale, with fragmentary vegetable remains highly-carbonized, about one foot thick—under this, is a reddish-grey sandstone. Passing Northward along the face of the cliff, the Coal thins out to one foot, and again increases to five feet. Owing to the thick covering of timber and of fallen debris the section is not very easily made out. Limestone of precisely the same character, as that at Cherra Poonjee, and containing nummulites and other similar fossils, occurs under the Coal separated as at Cherra Poonjee by thin-bedded and strong sandstones. The much greater distance of this bed of Coal, from the plains, and the greater elevation at which it occurs, will prevent its being economically used, excepting for local supply.

Coal is also found at, or near to, the village of Bairung, South of Cherra Poonjee; and at a much less elevation (1,250 feet above sea level). It is seen in a deep dell, or kind of amphitheatre, in the rocks. Imbedded in sandstone, there are some few irregular appearances of the Coal. It has been slightly opened out, and worked. The dip is from 3° to 5° to South. The *Coal* occurs in irregular beds of carbonaceous mud, mixed with sand and clay, with occasional patches of tolerably good Coal imbedded. It is in three distinct layers, and the section in a descending order, is as follows:

| | ft. | in. |
|---|---|---|
| Thick-bedded sandstone, ... ... ... ... ... ... ... | | |
| Sandstone, hard and fine-grained, ... ... ... ... ... | 1 | 4 |
| Coal, tolerably good, from 8 in. to ... ... ... ... ... | 1 | 6 |

| | ft. | in. |
|---|---|---|
| Coal, or a carbonaceous mud, with many carbonaceous particles imbedded, so as to be rudely inflammable, | 3 0 to 6 | 0 |
| Sandstones, (clean sharp freestone,)... ... ... ... ... | 11 | 0 |
| Coal irregularly-bedded, soft and earthy,... ... ... ... | 1 | 6 |

From this section it will at once be evident, that no good Coal can be looked for from this deposit.

I had no opportunity of visiting the Coal said to occur near to Cheyla, and further to the Westward near Laour. The beds which occur to the East of Cherra Poonjee at Lakadong, I have already described; (*a*) and I have also referred to the Coal found close to the village of Tung-ji-nath, South of Nonkradem.

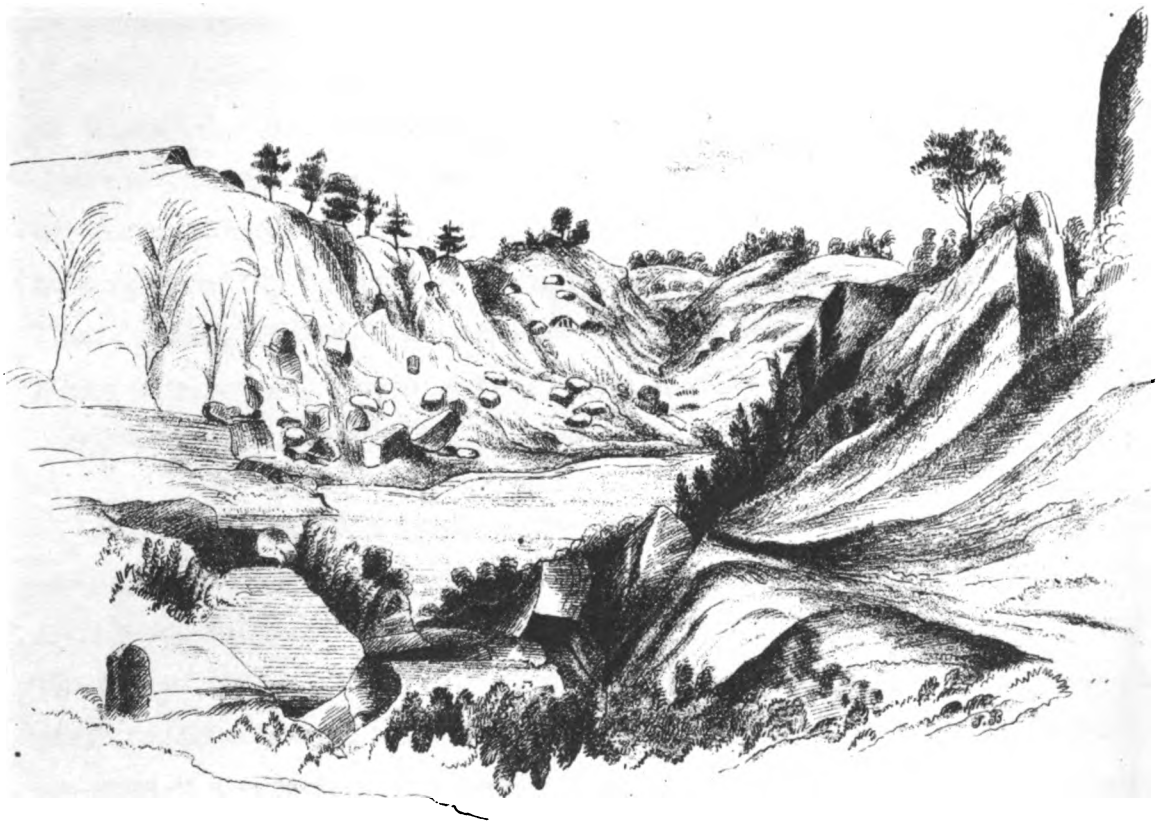
As regards the extent of the Cherra Poonjee bed, which is the most important, it follows of course the ridge of the limestone, (*see* Map A.) and crops out at intervals round its bluff escarpment. Thus the Coal is seen at the most Northerly point of this ridge, and again near to the road from Cherra Poonjee to Maw'smai. But independently of the very irregular development of the Coal itself, and the want of continuity in the bed originally, a large portion of the surface included within the outline of the limestone, as shown on the Map, has been subsequently denuded of the upper beds of sandstone, Coal, &c., while as I have already noticed, other portions have been removed by falling into, and filling large cave-like excavations, in the underlying limestone. I shall have occasion to refer again to this question of the amount of Coal to be found here.

A fault, or rather a group of two or three small faults cuts this ridge, and has upthrown the Coal, limestone, &c., on the West about forty feet. This fault heads North 35° East or nearly North-East. It is rudely parallel with the face of the ridge on the West, which has itself in all probability been the result of the degrading forces having acted upon or against a line of division in the mass of the rocks. The main joints in the limestone have also the same direction.

(*a*) Report submitted October, 1851.

Fig XVI.

Fig XVII.



DRAWN ON STONE & LITHOGRAPHED AT THE ASIATIC LITHC: PRESS. T. BLACK, LITHR: CAL.

IGNEOUS ROCKS.—*Granite.*—In describing the sedimentary rocks in the preceding pages, I have in several places incidentally referred to the occurrence of granite, both in veins and in mass. The largest area of this rock which occurs in the portion of these hills we have visited, is about the great iron-washing villages of Molim and Nonkrim. Its boundary stretches with an irregular outline from the southern flanks of Shillong hill, passing the villages of Lungqueer and Mawreng, and crossing the Boga-pani a little north of Laikro. From this it turns Eastwards, and skirts the river on the southern bank towards the village of Lailangkot. Another large granitic area occurs to the west of this, stretching from the village of Lybersai, south of the ridge on which are placed the villages of Cockleederah and Cudderah, towards Lunkoi.

Throughout this area, the lithological character of this rock is tolerably persistent. It is a highly felspathic and largely crystalline rock: the felspar being of two kinds; one whitish-pink, which together with the other ingredients forms the general mass of the rock, the other of a deep flesh-red colour, in large crystals, which, imbedded in the general paste of the rock, give it a porphyritic character. The quartz is generally of a greyish-white tint, but not abundant, the mica blackish and greenish-black. Hornblende does occur, but is rare. The granite presents also another character, often seen in such rocks, namely, the occurrence of huge masses of a harder texture, and slightly different proportionate composition, imbedded in the general mass. These masses are not so largely crystalline as the ordinary granite adjoining. Owing to the large amount of felspar, which enters into the composition of this granite, it decomposes readily, and for a depth of many feet from the surface is quite soft and incoherent.

Imbedded in the mass, and forming almost as constant an ingredient in the composition of the rock as any of the other minerals, occur small crystalline grains of titaniferous iron, which, from their abundance locally, give the rock a very spotted aspect. They are not equally distributed, being absent, or comparatively absent in the harder imbedded masses, and abundant in the adjoining softer portions of the rock. There is no vein of this ore, but it occurs freely

disseminated, and associated with the other minerals. It appears, on the whole, to be more abundant near to the junction of the granite with the overlying rocks than elsewhere. As yet no excavations have been made to any depth sufficient to enable an opinion to be formed, as to whether the presence of this ore continues in depth or not.

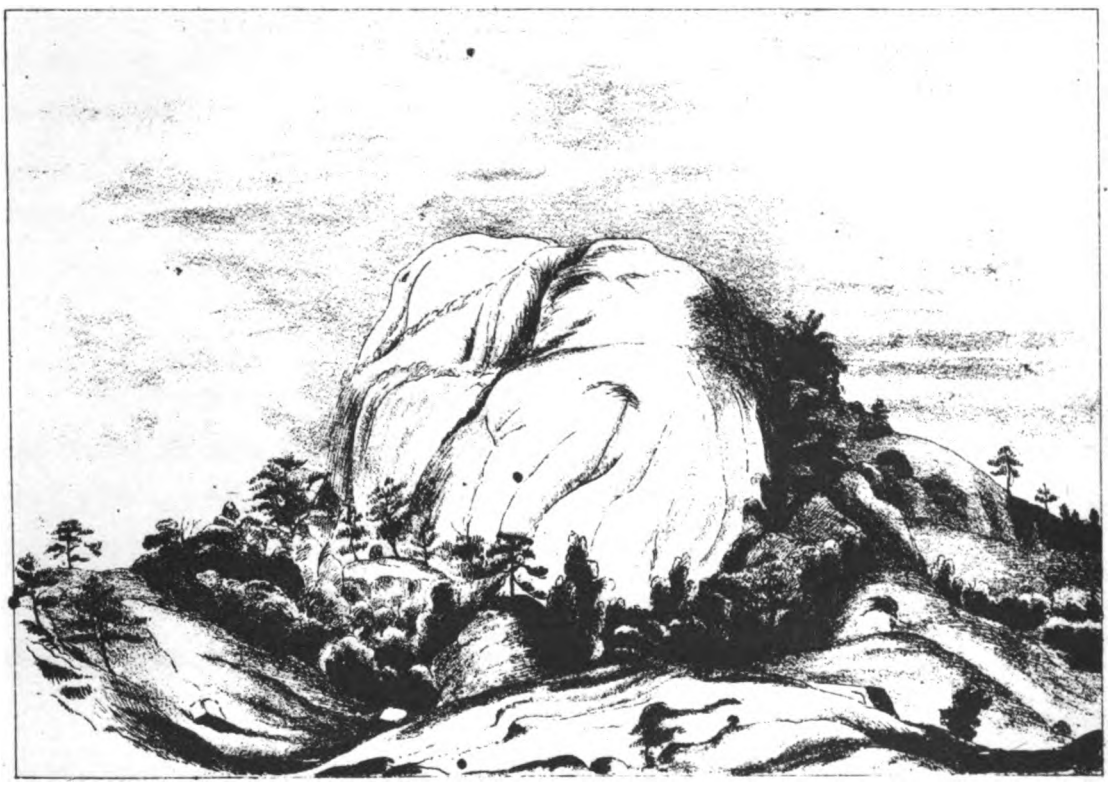
The simple mode of extracting this ore from the granite, adopted by the Khasis, is to loosen the soft, and partially decomposed, granite, with a long iron rake, and suffer the loosened masses and sand, to fall into a running stream below, by which the disintegrated particles, are still further separated, and the lighter minerals being carried away, the heavier portions, including all the iron ore, remain, to be again more carefully separated by repeated washings. In this process, the softer portions only of the rock being removed, the huge lumps and masses of harder consistency, being deprived of their support, fall, and are heaped around in the greatest confusion, where they remain gigantic monuments of former workings. In many places, through the hills, great piles of these immense blocks, now perfectly overgrown with moss, bear testimony to the industry of the natives in former times. Some are of immense size, and the accumulation of these masses, occasionally grouped in the most fantastic forms, gives a strikingly characteristic feature to the scenery of the granite country. The accompanying sketch of the valley of Nonkrim, will give some idea of the great size, and confused heaping of these blocks. (*Fig.* 17.)

A similar blocky character is given to all the glens, in the granite district, even where no iron workings have ever existed, and where there has been no excavation, artificially, of the rocks. Contrasting the view already given (*Fig.* 3) of the ridge on which Nonkradem is built, and its remarkably flat top and precipitous sides, with the glen to the north in the granite (*Fig* 18) seen from the same point of view, the difference is at once evident.

Granite, of similar lithological character is seen again several miles to the eastward of the districts to which we have just referred. It shews on the

Fig XVII.

Fig: XIX.



surface four or five miles North of the Joowye, and again near to the village of Pooring, and between that and Nurtiung. It is essentially the same in composition as that near Molim, though not quite so largely crystalline. The boundary of this granite I had no opportunity of tracing out.

Independently of these more extended areas in which granite occurs, it is seen in some more limited and isolated positions. Of these the most remarkable is the curious and very prominent rock, called the Kullong. (*Fig.* 19)*(a)* This huge mass of granite stands up boldly from the undulating surface of the country around, looking like a great dome of some 500 feet high. To the East and North-east it slopes a little more gradually; and here it is thickly clothed with timber. On the Western and South-western sides it presents a naked mass of rock rising nearly perpendicularly (from the depressions in the ground below) upwards of 700 feet. Round its base some large and fine pine and other trees cluster, the dark foliage of which contrasts beautifully with the naked, and weather-beaten face of the rock itself. This very remarkable rock is one mass of highly crystalline granite, rising from the rounded teelahs of the gneissose country around. To the West, judging from the immense blocks which are strewed over the surface, the granite would seem to extend, but on the South, the East, and the Northern sides, the bedded gneiss and slates encompass it. It appears to be in fact, an exhibition by nature, on a gigantic scale, of a phenomenon similar to that which may be seen throughout the entire of the granitic area, and to which we referred above, namely, the occurrence of those huge blocks of rock imbedded in, and of a similar character to, the mass, though much more highly indurated. The Kullong rock would seem to be a monster exhibition of the same fact, which no human hands have exposed, but which the action of natural causes, continued for ages, has laid bare.*(b)*

In the same parallel with the Kullong, and to the East, granite occurs cutting through, disturbing, and altering the slates in junction with it, near the

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*(a)* See also *Fig. 5.*

*(b)* As might be supposed, with a tribe whose prayers are chiefly, if not solely, offered up to avert the wrath of spirits, whom they imagine to dwell in woods and rocks, this Kullong is asserted to be the abode of a powerful demon, or spirit, whose enmity a Khasi dreads much to evoke.

village of Laidom. This exhibition of it is interesting from the fact of the outlier of sandstones which occurs here, resting quite undisturbed and horizontally upon the granite, and on the adjoining slates, the surface of both having been planed down to the same general level prior to the deposition of the sandstone upon them. The granite is seen at both sides of the isolated cap of sandstone. *(See Map A.)*

The occurrence of huge blocks of granite in several other places throughout the hills, indicating the former existence of washings for iron ore, points also to the existence of this rock in these places. Time however did not admit of a detailed examination of these localities. I have therefore preferred on the map, to include these in the general area occupied by the metamorphic rocks, which are pierced by innumerable granite veins, rather than to attempt an amount of detail for which I had not sufficient data. Thus, at Nungrumai, (Normai) and at Nungklow, and in some other localities, there is no doubt of the existence of granite, but probably very limited in area.

I have already described the occurrence of granite in considerable mass and also in veins of varying size, and composition, in connection with the azoic rocks of the Temshung valley to the East of Cherra Poonjee.

A reference to the map will show that the points at which granite shows through the hills have a definite arrangement, and occur on lines having an Easterly and Westerly direction. Thus the granite of Lunkoi on the West is continued by the granite of Molim and Nonkreem, and still further East by that which shows near Pooring and North of Joowye; while the line of the Kullong is shown further to the East in the exhibition of this rock near to Laidom.

GREENSTONE.—This is another interesting form under which igneous rocks are exhibited in the Khasi Hills.

The most important locality where these trappean rocks occur has been already alluded to in describing the sandstones of Cherra, and the alterations which have resulted from the contact of these volcanic rocks in a molten state. A few words of additional detail will therefore suffice here. The rocks which form the greater portion of the valley of the Kala-pani, and of that of the Boga-pani and the small intermediate glen, are throughout of a very constant lithological character. They are all a basaltiform greenstone, dense and close grained, with very few, and small vesicles, or air bubbles. The rock divides into prismatic masses, which gives it in places a semi-columnar aspect; but this structure is not well developed. Where long exposed it decomposes on the surface into a ferruginous ochrey sand. Near the junction with the overlying sandstones this greenstone is traversed by numerous small veins of quartz which fill all the cracks and fissures in the mass. These do not occur at any distance from the sandstone, and appear to be the result of the subsequent filling in of these cracks by silica, derived from the overlying siliceous rocks. This is the general character of the rock throughout the large area over which it is exposed.

North-east of Mowphlang, greenstone occurs, not in the form of a great underlying sheet of rock supporting the sandstones; but as a dyke, or wall of this igneous rock, cutting through the beds of the mechanical series. Here the character of the rock is somewhat different; instead of the basaltiform structure, and composition, which prevails in the mass, it is diallagic, more largely crystalline, and is a true diallagic greenstone. I am disposed to view it, however, notwithstanding this difference in aspect, as connected with, and an off-shoot of the great mass of greenstone to the South.

Other dykes occur in the district South of the village of Laikro which have, though in a much smaller degree, the same mineral aspect.

All these dykes have a common direction, namely, they all head or strike nearly due north-east coinciding with the main or general direction of the great river valleys in which the greenstone is so well exposed.*(a)*

Trap rocks are also seen South of Cherra Poonjee, below the great ridge or West of the hill. Under Mawm'luh village, at an elevation of about 2,400 feet above the sea, or about 1,700 feet below the level of Cherra and forming the top of the small ridge which here unites Mawm'luh with the partially detached hill on which Laikenso is placed, there occurs an earthy greenstone or claystone, in places very ferruginous; its fissures being coated with peroxide of iron. It is highly vesicular, the cavities being filled with agates, and agaty flints, of various colours. The rock itself is of a blueish tint. The deeply-coloured flints, in which a deep earthy red is the prevailing tint, have been described as jasper. (Gleanings in Science, vol. i. p. 374.) The colour in some pieces is good, but I did not see any lumps of good size; and most of the pieces are greatly shattered.

An earthy greenstone similar to this is also met with in passing down from the Mahadeo to Bairung village, and at about the same elevation. The

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*(a)* The road from Cherra Poonjee to Gowahatty in Assam, passes for several miles over this greenstone between the valley of the Kala-pani and that of the Boga-pani. This excellent road reflects the highest credit on the skill of Col. Lister, who planned and executed it throughout. It is, with scarcely an exception, admirably laid out, and constructed; while the remarkably well-turned bridges of cut stone, by which the larger streams are crossed, show what can be done by the well directed intelligence of the natives of these hills. It is, I think, only to be regretted that the undivided charge of such a road, should not be placed under one person, and that the delays consequent on complicated references to other departments should prevent the full amount of utility being reaped from such an undertaking. The communication across the Boga-pani, one of the largest and most dangerous streams on this line of road was interrupted early in 1851 by the carrying away of the Suspension Bridge in a great flood, which flood also swept away several other bridges on the road. These latter have all been repaired, or renewed, but I understand that nothing has been done to re-open the communication across this torrent. The mail bags are still I suppose passed across during the rains suspended to a rattan stretched between the banks, and the only means of crossing for some months in the year is by a temporary bridge of the rudest construction put up by some natives, and for passing which a toll is demanded. Yet two cold seasons have elapsed since the destruction of the bridge; which, having been an iron suspension bridge, was under the charge of the Military Department, all the road, and the stone and wooden bridges, being under the charge of the Political Agent for the Khasi hills, by whom the communication would have been restored in the same number of months.

ground between these two localities is too densely covered with jungle to permit its examination, with a view to tracing the continuity of this trap.

A thick vein, or dyke of highly crystalline greenstone passes in a north-east, and south-west direction across the rocks, a little west of Mooshye; and a similar mass is seen to the east of the villages of Rasheer and Pooring, holding precisely the same general direction, and probably connected with that near Mooshye. It is of the same basaltiform aspect as the greenstone seen near the Boga-pani and Kala-pani rivers.

Looking at this well-marked direction of the various dykes or masses of greenstone seen within the area examined, and its constancy, and taking it in connection with the direction of the faults observed in the Coal at Cherra Poonjee; with the direction of the principal joints, or planes of division existing in the limestones there; with the direction also of the great lines of river-valleys, which a reference to the Map will shew to be remarkably parallel within the sandstone area, and which undoubtedly have been formed along great lines of disturbance; we are I think justified in concluding that the greatest force of these intruding igneous rocks has been exerted in a direction nearly north-east, and that consequent on this force there has been a series of divisional planes produced in the mechanical rocks, which have a parallel direction. And that these divisional planes, associated in some cases with actual dislocations or faults, have influenced very largely the operation of the ordinary degrading forces in producing the present features of the district.

GEOLOGICAL AGE, &C., OF THE ROCKS.—In the preceding description of the lithological aspect, and mode of occurrence of the various rocks in the Khasi hills, I have not entered at all into the question of their geological epoch, except in the most incidental manner. The full discussion of this interesting question can only be undertaken after a careful examination of the fossils occurring in these rocks, and I shall therefore reserve all details

of this kind for a future occasion, at present simply stating in the broadest way the general relations of the rocks.

With reference to the mechanical rocks described above under the general head of "metamorphic," I have already stated that, so far as they have been examined, they are entirely and completely *azoic;* no trace of either animal or vegetable remains having been found in them.

The group of sandstones, limestone, coal, &c., resting upon these, is of much greater interest. In these, many organic remains occur, some of which have been incidentally alluded to. Of these certainly the most characteristic are the fossils of the limestone beds, and among these the nummulites are most important. The existence of these fossils in the so-called "Sylhet limestone" had been long known. It was pointed out by Mr. Colebroke in his valuable paper on the geology of the north-eastern frontier of Bengal,*(a)* and has subsequently been alluded to by several other writers. The *tertiary* age of this rock inferred from the occurrence of these fossils, had also been more than once referred to, and generally acknowledged. In the most recent account of the geological structure of these hills, Dr. McClelland speaks of this rock, but refers it to the parallel of the upper portion of the cretaceous group of Europe. The state of geological knowledge regarding the distribution of these remarkable foraminifera, at that time, undoubtedly justified this author in making this reference, although from more recent researches, most geologists would now agree in thinking that the rocks containing these nummulites belonged to the earlier *tertiary* era.

But this reference of Dr. McClelland's only relates to the limestones found near Teriaghat at the base of the hills; and he distinctly draws a marked line of demarcation between these and the limestones found close to Cherra Poonjee station which latter, together with the associated Coals, he refers to the lowest portion of the Coal measure group,*(b)* and to the same age as

*(a)* Geological Transactions, London, Vol. i. 2d Series.
*(b)* Reports of Coal Committee, Calcutta, 1838, pp. 26, 33 and 1846, pp. 100, 103.

the Coal beds of the Hazareebaugh and Nerbudda districts. It would be quite out of place to discuss here the age of the latter deposits, or that of the great Coal-fields of the Damoodah and Adji. It will suffice to state simply that there are no grounds whatever for referring the limestones, and other rocks which occur at Cherra Poonjee, to an older geological epoch than those found at the base of the same hills. They are both nummulitic; they are both mineralogically alike, and both unquestionably belong to the same great division of geological time.

There is some little difficulty in ascertaining exactly what Dr. McClelland's views, regarding the arrangement of the rocks at Cherra Poonjee were. In the earliest announcement of his discovery of fossil shells in these hills, made in September, 1835,*(a)* he merely states, "that he had discovered a large number of shells at various altitudes from 1,000 to 4,200 feet, and even in and around the station of Cherra Poonjee itself," among which he thought he recognized Pectens, Turritella, Melania, Serpula, Cirrus, Pleurotoma, &c., "and that these remains were in rocks hitherto considered as primitive." In the following year, he exhibited to the Asiatic Society, Calcutta, the collections made by him during his trip to Assam, and stated that fossil shells were found in such number and variety at Cherra Poonjee, as to afford most unquestionable evidence "of the tertiary nature" of the Kasia mountains: and further, that when the specimens had been compared with the fossils from the Paris and London basins, "it might be possible to find their place in the Eocene and Pleiocene groups of Lyell." While this would seem to indicate that he referred to the epoch of the formation of the rocks, and not to that of the formation of the mountains, the next sentence appears to shew that it was the *period of upheavement* to which he alluded, as he thinks this is the first instance of "any extensive deposit of fossil shells in the Sub-Himalayan rocks, calculated to throw sufficient light on the period of their "upheavement."*(b)*

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*(a)* Journal Asiatic Society, Bengal, Vol. iv. p. 520.
*(b)* Journal Asiatic Society, Bengal, Vol. v. p. 419.

In the following year (1837), a short communication from the same author was read at the Geological Society, London, in which he refers to the nummulite limestone at the base of the hills, and to the occurrence of fossil shells in a "well-defined marine beach" at about 1,500 feet above the sea out of his collection from which he had identified about twenty species as identical with Paris-basin fossils. Next referring to the Cherra Poonjee limestone, he describes it as reposing on the sandstone of the hills, and as having afforded him twenty-seven species of shells, among which he identified *Pileolus plicatus* of Sowerby.*(a)* On this limestone rest the coal, &c.,*(b)* In the Report of the Coal and Mineral Committee, greater details are given; and in discussing the question of the relative levels of the Indian Coal-fields, and the causes to which this may be referred, the same author states that the Coal of Cherra Poonjee is accompanied by rocks identical in nature with those found bearing a similar relative position to other beds of Coal of the same formation; refers the great thickness of sandstone which occurs under the Coal, and limestone to the old red sandstone of English Geologists, and alluding to the similarity between the limestone which occurs beneath the Cherra Coal, and that of Central India, proceeds to state, with reference to the researches of Mr. Scott, and Mr. Cracroft, that, "no Chronological distinction had been "previously established between the limestones in this quarter, although the "Cherra rock is distinguished as a formation from the nummulite limestone, "as well by means of its fossils, as by the beds with which it is associated."*(c)* The same author again described more particularly the occurrence of these fossil shells in the so-called beach, and states that in one place the Echinida which occur with them (*Cyrtoma*, of McClelland) are found "in a greenish-"grey friable sandstone, which will probably prove to be the equivalent of the "green saliferous marls of the upper New Red sandstone."*(d)* According to this determination, therefore, there would be in the Khasi hills representatives of the old red sandstone; of the carboniferous; of the new red sandstone; the cretaceous and the tertiary groups.

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*(a)* This, however, is an *oolitic* fossil.

*(b)* Proceedings Geological Society, London, 1837, June 12.

*(c)* Report Coal Committee, 1838, p. 33.

*(d)* Calcutta Journal of Natural History, Vol. i, p. 155.

Now whatever question there may be as to the relative position of the limestones which occur at the base of the hills in many places, and those found at the top ; there can be no question whatever as to the relative position of the sandstone in which these Echini occur, inasmuch as the succession of beds can be uninterruptedly traced upwards from it to the limestone and coal of Cherra Poonjee station. If therefore these sandstones, occurring on the slope of the hill, belong as Dr. McClelland thinks probable to the new red sandstone group, it is difficult to see how he can refer the limestone and coal, which occur some 1,500 feet stratigraphically above them, to the carboniferous epoch.

There does not appear to be any ground for supposing that this limestone belongs to a different geological era from the sandstone below it. They are both perfectly conformable, and have formed a continuous, and uninterrupted series of deposits ; the calcareous nature of some of the sandstone beds proving that the sources of lime existed long prior to the formation of the purer calcareous muds, now constituting the limestones. It is possible that some of the sandstone beds may have been geologically coeval with the upper or latest portions of the cretaceous group of Europe (and this question can only be decided by a careful comparison of the organic remains): but there is little doubt that the Cherra limestone is of the older tertiary epoch.(*a*)

But whatever question may exist regarding the geological date of the sandstones below, there can be none whatever, that the sandstones, coal, &c., above, this limestone are either of the same epoch as the limestone itself, and therefore Eocene, or of a still later date. In either case this Cherra Coal

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*(a)* While thus differing, altogether, from the conclusions of Dr. McClelland, I am anxious to bear the strongest testimony to the general accuracy of his descriptions; and to state my conviction that the errors in his deductions arose much more from the state of geological knowledge at the time he wrote, than from any want of proper investigation on the part of the author. The notion, by no means fully exploded in 1838, that good coal could only be found associated with rocks of a certain era in geological succession, would seem to have held such sway over his mind, that, to meet this difficulty, the stronger evidence of organic remains (which Dr. McClelland to a great extent interpreted accurately) was rejected, or explained-away on an untenable hypothesis. The extent of the author's researches during his very brief visit is the most convincing proof of the *zeal* which he brought to his investigations.

(which has hitherto been referred to the lowest portion of the Coal measures) is undoubtedly *tertiary*.(*a*)

I have above described the appearance presented by the upper surface of the limestone, and the curious manner in which it has been scooped out, and the hollows filled either by sandstone or vegetable matter. For such degradation of the surface, I conceive that a considerable time must have elapsed, and a considerable change of condition have occurred. And it is, therefore, possible that this bed of Coal, and its associated sands, (for so slightly indurated are they, that they scarcely deserve the name of sandstone) may belong to a still more recent sub-division of the tertiary group than the underlying limestone ; and that this may be, at Cherra Poonjee, the last remaining relic of a series of beds corresponding in time, with the largely-developed groups of the Siwalik hills and of the Salt range ; beds analogous to which the researches of Mr. Scott have proved to exist along the flanks of the Garo hills, not far from the Khasi range.

No fossils have been as yet discovered in these overlying beds, which would throw any light upon this question, and the occurrence of beds of similar Coal, much lower in the series, and associated with the sandstones, (as at Tung-jinath), and of precisely similar nummulitic limestone repeated above the Coal (as at Lakadong) tends rather to prove that they all belong to the same formation. In either case, this Coal, which has here been so far mineralized, as to produce a good blazing Coal, of a fine jetty aspect, and highly bituminous character, is the representative of the thin, and small patches of lignite which occur abundantly in the tertiary strata of the North-West.

And this analogy strengthens the conclusions drawn from an examination of these deposits in the Khasi hills, as to the uncertainty of any continuance of these seams. Both with reference to the Coal at Lakadong and at Cherra

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(*a*) Of course, all the reasoning founded on this assumption, and the comparisons thence drawn between the Coals at Cherra and at Hazareebaugh, &c., as to quality, and the cause thereof, cease to be applicable.

Poonjee, I have already pointed out the very irregular manner in which the beds have been developed ; and I am inclined to think that this is only another instance in which the deposits of vegetable matter, belonging to this geological epoch, are of local and limited extent, resulting from local and limited causes.

As far as my researches extended, no trace of any formation of a date intermediate between the primary azoic slates, and the tertiary Eocene group, was found.

With a few brief remarks on the disturbances to which these rocks have been subjected we shall conclude the foregoing outline.

The tendency which the great granitic areas have to form lines with a direction East and West has been noticed above. The only really marked instance, however, of granitic intrusion, as distinct from granitic disturbance and elevation does not exhibit this direction (at Laidom) ; and from this and other circumstances it would appear that the line or axis of the greatest granitic exhibition has been a line of elevation, and not of intrusion or fracture : in other words, that the disturbances, or dislocations on this line have been long subsequent to the alteration of all the rocks affected. On the other hand, the disturbances resulting from the exhibition of the other class of igneous rocks (the traps) have taken place along the lines, or line, of intrusion, and of fracture. I have above noticed the coincidence in direction between these intrusions, and the principal river-valleys in the Southern part of the hills and the dependence of the physical features of the district on this geological structure.

Along the base of the hills, from the parallel of Cherra Poonjee, to Burr-ghat, not continuously, but with few interruptions, as far as I know, limestone is found extensively almost at the level of the plains. Now this limestone is of very similar character, to that which is also found at the top of the ridge. It contains many of the same fossils and altogether is very like the beds above. It is invariably at considerable angles of inclination from 40° to 60°, (instead of horizontal as in the hills, and for the most part this inclination dips away

from the general range. This is well seen South of Burr-ghat, and may also be noticed near to Teria-ghat. Resting upon this low-lying limestone there occurs a great thickness of sandstones of varying character, with intercalated shales. These are well seen in the banks of the Harry river, leading up to Burr-ghat; and throughout they appear conformable to the limestone. As I have already stated, that in consequence of the season of the year it was unsafe to visit these localities, I can only mention the occurrence of these rocks and regret that I could not more satisfactorily examine them. But coupling the remarkable similarity of the limestones above and below, with the remarkable continuity of the beds at the base, I think there is evidence to shew that the present steep face of the hills to the South is formed along a great line of fault, stretching nearly due East and West; and that from this the very remarkable rectilineity in the direction of this range has resulted. The direction of this line of steep escarpments coincides with the direction of the granitic elevations, and has possibly resulted from the same force.*(a)*

Accompanying this great disturbance there is also some confusion along the face of the hills, arising from the necessary occurrence of many great slips and fallen masses; and the whole surface subsequently becoming densely clothed with forest, it is no easy task to unravel its complicated structure, or to obtain a clear insight into the causes which have produced it.

I shall here briefly enunciate a few of the principal conclusions resulting from a general review of the previous descriptions of the geological structure of these hills. These are ; that the general basis of the range is granite ; resting upon it is a series of metamorphic rocks, gneiss, micaceous slates, quartz rocks, &c., which have been greatly altered, disturbed and contorted by the granite which now supports them ; that in connection with these changes there appears to be evidence to shew that the line of greatest disturbance caused by this granite had a direction East and West. Subsequently to these disturbances and alterations of the older slates, these rocks have been subjected to long con-

*(a)* Dr. McClelland indicated the existence of a great fault along here in his accounts of the structure of these hills. Reports, Coal Committee, 1838.

tinued and great wear, and denudation ; and upon their degraded surface was deposited a series of beds of sandstones, and limestones, of varying character, but in the aggregate of considerable thickness. Throughout the whole of this series, from top to bottom, in the conglomerates found at its base, in the clean sandstones higher in the series, in the fossils found in these beds, in the irregularity of their development, and the constantly repeated occurrence of current marking and "false bedding," there is sufficient evidence to prove that the entire group, not less than two thousand feet in thickness, has been deposited and formed in water of no great depth. The same evidence is extended by the organic contents of the limestones. To admit of this occurring, there must have been a gradual and continuous depression of the surface within this area, maintained during the deposition of the whole of the series. These sandstones have subsequently been invaded by other igneous rocks which have been forcibly intruded among them, and have produced great alteration in their texture and structure, and have greatly disturbed their position. There is no evidence to shew the exact period at which such intrusion took place ; but it must have been subsequent to the formation of all the sandstones.

The whole series has been subsequently elevated until it attained its present position. There is no sufficient evidence to shew whether this elevation or rather the commencement of this elevation, was synchronous with or not, or was caused by, or accompanied by, the intrusion of the trap rocks.

The elevation of the rocks to their present position must, however, have been gradual and long continued to admit of the remarkable conditions under which we find these beds, as shewn by the many, detached, and small outlying portions of these rocks, at considerable distances from the main mass.

Coincidently with and subsequent to this elevation of the hills, *en masse*, the ordinary atmospheric causes of degradation, which, owing to the peculiar climatal conditions of the district, are here exerted with great force, have been in operation to produce, and modify the present aspect of the surface. And, further, the action of these forces appears to have been determined, as to

the *direction* of its maximum effect, by a series of lines of jointing and fracture, and occasionally of dislocation, or faulting, resulting from the earlier intrusion of the volcanic rocks

The very gradual, and continuous slope of the plains at the foot of the hills will shew that long subsequently to the period of their elevation, a sea had washed their base, and levelled the widely extended flats, from which their steep escarpments rise.

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# ECONOMICAL GEOLOGY

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In the preceding pages, a brief outline of the Geological structure, and a few notices of the mineral products of the Khasi hills have been given. Some of these products are important both from the extent to which they are wrought, and from their being the great source of supply for the large demand of the Calcutta and other markets; and others from the possibility of their being applied to meet a demand at present unsatisfied. It will therefore be desirable to enter into somewhat greater detail respecting these.

The most important are, Lime, Coal and Iron; and in that order I shall give a few further particulars of the circumstances under which they occur, the conditions affecting their conversion, and the economical purposes to which they are applicable.

*Lime.*—The so-called "Sylhet limestone" has been long known. I can not find any record of its first use in the production of lime, though in 1828, Mr. Inglis was well established at Chattuc as an extensive manufacturer of lime;*(a)* and in the year 1830, the "manufacture of the Sylhet lime" is described as a generally known trade.*(b)*

The vicinity of the Khasi hills is still the great source of lime for the supply of the Calcutta and other markets.

The extent of this trade, and the importance of the product, as an element of progress in civilization, demand a brief reference to the circumstances attending it.

The principal localities of the manufacture are at Chattuc and at Sonamgunge, and along the banks of the river Soorma, between these two villages.*(c)*

*(a)* Asiatic Researches, Vol. XVII., page 499.

*(b)* Gleanings in Science, Vol. II., February 1830, pp. 61, 63, article signed T. R.

*(c)* The name of the latter village, Sonamgunge, appears to be derived from this manufacture, and to be a corruption of *Chunamgunge* or *lime-village*. It is a large and populous place, and is the market-town

The rude kilns in which the stone is burnt stretch for miles along either bank of the river ; and the many large, and well-constructed buildings, in which the lime is stored until required for market, give an aspect of wealth, comfort, and prosperity to the district which contrasts forcibly with the almost unlimited extent of marsh and jheel that bounds the view on either side lower down the river.

Almost the entire range of the limestone quarries, along the base of the hills, eastward, from *Cheyla*, belong to the firm of Inglis and Co., whose principal establishment is located at *Chattuc*. Westwards, the quarries in the neighbourhood of *Laour*, and some smaller quarries between, are in the hands of Mrs. Stark, Mr. Sarkies, and of some native merchants.

The extent and importance of the trade will be more evident from a consideration of the quantity of stone raised annually, and of the quantity of lime produced. On an average of 10 years, ending in November 1851, the amount of limestone quarried on the borders of the Khasi hills, is stated to have been :

| | | |
|---|---|---|
| By Messrs. Inglis and Co.,... ... ... ... | Maunds | 14,48,550 |
| „ Mrs. Stark, Mr. Sarkies and native merchants, ... ... ... ... ..... | „ | 2,31,500 |
| Total average amount quarried annually,... | „ | 16,80,050 |

equal to 60,000 tons of limestone yearly.*(a)*

| | | |
|---|---|---|
| From this stone there have been burnt by natives, who have for the most part purchased the stone from Messrs. Inglis and Co., on the average of 10 years annually, ... ... ... ... ... ... | „ | 12,34,000 |
| By Messrs. Inglis and Co., ... ... ..... | „ | 1,57,000 |
| „ Messrs. Stark, Sarkies, &c., ... ... ... | „ | 80,000 |
| Giving a total average amount of lime,..... | „ | 14,71,000 |

for an extensive district. It is beautifully situated on the Soorma where this river makes a sudden bend to the South, and commands an extended view of the range of hills to the north.

*(a)* I am indebted to the kindness of Henry Inglis, Esq., Cherra Poonjee, for the above information, extracted from th books of the firm for me : Mr. Inglis states, that, "the quantity given above, as burnt by natives, may have been a little less, certainly not more, but the difference is not great one way or the other."

The whole of this very large amount is quarried from the several places along the foot of the hills, where the limestone occurs close to the level of the plains, and from whence it can be removed by water. The quarrying of the stone is carried on at all seasons, but chiefly during the spring and cold months, and the stone, broken into pieces of convenient size, is piled up in suitable localities until the rains in May, June and July fill the little streams from the hills sufficiently to float the small dinghies or canoes which are here used. As soon as this takes place every available boat is at once employed for the removal of the stone into the larger streams. It is scarcely possible to conceive a busier scene than the neighbourhood of some of these large quarries presents after a good fall of rain. Hundreds of men and women are busily engaged loading their canoes, and then rapidly shooting down the narrow stream, while others are hastily poling the returning empty boats up the current, again to load, and shoot down the rapids with their freight of stone. The whole place seems alive with eager workmen, who know well, from experience, the necessity of taking advantage of the sudden rise of the waters. So sudden is the fall sometimes of these little nullahs, that even these light canoes which draw only a few inches of water, are frequently left stranded in the middle of their course.

In this way the greater portion of the stone is removed from the quarries, these small dinghies carrying the limestone only into the larger streams where all is quickly thrown on the bank, or into the water near the bank, to be again re-shipped into larger boats for conveyance to the place of manufacture.

In that portion of the hills, which lies more immediately to the south of Cherra Poonjee, the largest quarries are near the village of *Tungwai* or *Tingye* from which the stone is brought to the neighbourhood of *Pondua*, to be again removed from thence to *Chattuc*. Other very large quarries are in the vicinity of the great orange groves between *Teriaghat* and *Lacat*, from which also the stone is conveyed to *Chattuc*, for burning.

The whole of this limestone belongs to the nummulitic group. It varies but slightly in mineral character, and produces a good sound, but not very

strong lime, of good colour ; and slacks readily. Some of the beds, are magnesian, and more gritty in aspect ; and the lime from these is somewhat darker in tint, than that produced by the purer beds.

At present, the only fuel employed in burning this limestone, is wood, or reeds (called nál), principally the latter, which are collected in immense quantities from the extensive jheels in the vicinity. The kilns are placed on the banks of the river, which are cut down perpendicularly for some feet, to form the face, in which the opening into the lower part of the kiln is made. The excavation is circular in plan, and nearly semi-globular in shape ; and generally of sufficient size to take when piled up, from 500 to 700 maunds of stone. After ignition each kiln is, in ordinary weather, allowed to burn for about four days and nights, when the burnt lime is removed from the kiln, at the top. The kiln, if sound, is then again charged, again relighted, and after a sufficient interval again emptied.

The system, in ordinary use in Europe, of drawing the lime from the bottom of the kiln, and replacing it by fresh stone, and fuel at the top, so as to keep up a continued combustion, as long as required, is quite unknown in this district. Such a system, indeed, is quite incompatible with the rude, and imperfect kilns here in use, and also with the kind of fuel now used. There can be no question, however, that the cooling down of the kiln on the removal of each charge, causes a very considerable waste of heat, while the impossibility of burning lime, on the present plan, excepting during a few months of the year, entails a great additional loss. The burning, at present, does not properly commence until the end of January, or until February, and must be completed by April.

Twelve hundred maunds of stone yield on the average, one thousand maunds of lime, and will require from 3500 to 4000 bundles of nál or reeds, for their combustion. The stone delivered at the kilns, on the river bank, costs from 14 to 18 or sometimes 20 rupees per 1000 maunds.

I have no doubt, that the manufacture of this lime would be improved, and at the same time rendered more economical, by the adoption of the ordinary form of lime-kiln ; from which the lime is drawn below, and the charge renewed from above, while the burning is a continuous process. Consequent on this would be the use of Coal, as the sole, or at least as the greater portion of the fuel employed. For such purposes, the small coal, (of which a large proportion is necessarily produced in hewing the Coal of this district) would be most effective, and could thus be economized. At present while the cost of removing this small coal would be the same as for large coal, (*viz.* 4 annas per maund to Pondua) I am disposed to think that no great saving would result from its use. But any improvement in the facility of conveyance for the Coal from Cherra Poonjee would inevitably tend to a further economy in the manufacture of lime also. The highly blazing character of the Coal, and the consequent difficulty of keeping it burning in close furnaces, and in kilns, is, to a certain extent, an objection to its employment for such purposes : but this applies with less force to the small coal ; and a very few trials, would soon point out the proper proportion of fuel to be used, and the proper mode of charging the kiln. On the other hand the very small amount of ash or earthy matter in the Cherra Coal would be decidedly in favour of its use.

Much of this limestone would produce most durable, and occasionally very handsomely veined marble. It would answer well for ordinary purposes, chimney pieces, slabs for tables, garden seats and for flooring tiles. Of the latter article, I believe many hundreds are annually imported, of inferior colouring and beauty to those which could be manufactured out of this Khasi limestone.

*Coal.* The existence of Coal in the Khasi hills appears to have been first brought to notice in 1815, when Mr. Stark reported that he had found some beds in the lower hills of Sylhet, from which he forwarded specimens to Government. This Coal was examined at the Gun Foundry at Cossipore, at the Mint, &c. ; and being favourably reported on, Mr. Stark offered to supply any required quantity to the Government at one rupee, eight annas per maund. This offer was declined, and he appears to have obtained permission to bring to

Calcutta any quantity during five years, free of charge. Not finding sale however, for the first cargoes he brought down, he abandoned the mines.

Mr. Jones, in a paper "on the mineral productions of Bengal," describes the Sylhet limestone, coal, &c.; but he does not appear to have known, of the Coal at Cherra Poonjee.*(a)*

It does not appear that much further was done (partly in consequence of the disturbed state of the frontier) towards exploring these hills for Coal from this time until Mr. Cracroft in 1832 brought to public notice the existence of beds of Coal close to the station of Cherra Poonjee.*(b)* This discovery was followed up by the finding of other beds of Coal in various places in the adjoining district.*(c)*

Regarding this Coal, the most important information referring to the few succeeding years is to be found in the reports of the proceedings of the Coal and Mineral Committee, published in 1838-1846.

During the years, intervening between 1840 and 1844, a considerable amount of Coal was sent down from Cherra Poonjee, under the superintendence of Colonel (then Major) Lister, the Political Agent for the Khasi hills, part of which was sent to Dinapore, and the upper stations on the Ganges, but the larger proportion was sent to Calcutta.

In September 1844, the Government right in the Coal-mines at Cherra (which are held under a lease for ever from the Rajah of Cherra, dated the 20th April 1840, at a stipulated royalty of one rupee for every 100 maunds excavated by Government, reserving at the same time the right of all subjects of the Cherra Rajah to mine on their own account, which "the Government are not to prevent") was transferred on the same terms to Mr. Engledue, then the Agent

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*(a)* Gleanings in Science, Vol. I. p. 281, 1839.
*(b)* Journal Asiatic Society Bengal, Vol. I. p. 250 and p. 252.
*(c)* Journal Asiatic Society Bengal, Vol. I. p. 363, &c.

in Calcutta for the Peninsular and Oriental Company, the mines to be worked by him, either on the part of that Company, or on his own account.

It appears that from that time, the quantity of coal extracted from these mines annually, diminished considerably. In 1846, Major (now Colonel) Lister reported that "the mines subsequently to this transfer had not been worked with that spirit which was expected from the correspondence prior to their being granted; and that only about one-half the quantity, which was formerly sent down from the Agency had been sent down during that season on the part of Mr. Engledue's Agents, while he thought the cost, instead of being reduced, would be greater by some 30 per cent."

These mines having thus failed under Mr. Engledue's management, were transferred to the Sylhet Coal Company, or to their representatives, Messrs. Gisborne and Company, and have subsequently been under the management of several different persons. In no year, however, does there appear to have been forwarded from these mines, an amount of Coal equal to that sent down by the Political Agent at Cherra Poonjee, during the earlier years.

The great item of expense in the transport of this Coal, being the difficulty of conveying it from the mines at the top of the hills to water-carriage, Lieutenant Yule of the Bengal Engineers was ordered to report "on the means of transporting the Coal found near Cherra Poonjee to the plains"; and early in the year 1842, submitted a very elaborate and able report on this question. He suggested two distinct means of accomplishing the object required; one the formation of a road for the whole distance from the level of the plains, having such gradients as would be suitable for the use of ordinary carts: the other, a mixed plan, in which part of the distance should be traversed by an ordinary road, and part on self-acting inclined planes, or "railed descents," on which the descent of the loaded trucks should haul up the empty trucks returning; the speed, &c., being regulated in the ordinary way. The former plan of a continuous cart-road would involve the making of 16¾ miles of road, and the crossing of a river more than 200 feet wide; to bridge which would cost by Colonel Garstin's estimate Rupees 7,000. The total

expense of a mixed plan, of railed inclines and road, was estimated by Lieutenant Yule at Rupees 66,584, for the first construction. And this plan he strongly recommends in preference to the other.

I cannot find that any thing further was done to facilitate the transport of the Cherra Coal, subsequently to the submission of this report. And to the present day, any Coal brought down from these mines is carried on coolies' backs, as at the first.

It will be convenient here to investigate the actual cost of transport of this Coal.

In 1842, Colonel Lister had excavated at the mines and despatched to Chattuc 44,350 maunds of Coal. Of this quantity the cost at Chattuc was 4 annas $4\frac{6}{8}$ pie per maund; 39,750 maunds were sent to Calcutta at a cost for freight &c., of 3 annas $2\frac{3}{8}$ pie per maund, making a total cost in Calcutta of 7 annas $7\frac{1}{8}$ pie. Again in the same year, 65,955 maunds were delivered in Calcutta at an average cost per maund, including all charges, of 7 annas $3\frac{1}{2}$ pie. In 1844, February, 5,642 maunds were despatched, at a cost on an average in Calcutta of 7 annas $3\frac{1}{5}$ pie per maund. In November and December of the same year, 90,940 maunds were delivered at a cost (including loss of six boats) of 7 annas $9\frac{1}{2}$ pie per maund. In October, November and December, we find 21,126 sent down, but owing to a part of the carriage for these Coals having been provided by the Commissariat, I cannot state the average cost in Calcutta.*(a)*

We have thus on an experience of several years, the *average* cost of this Cherra Coal in Calcutta equal to 7 annas $6\frac{1}{4}$ pie per maund, or Rupees 47 per 100 maunds. This was the cost inclusive of all charges, for overseers, weighmen, coolies, freight, &c., excepting only any charge for superintendence and general management. I would add here, that all the establishment required for this purpose was temporary, and therefore more costly than permanent arrangements would have been.

*(a)* For this information, I am indebted to the permission of Colonel Lister to examine the contingent bills passed for the expenses attending the despatch of this Coal.

Lieutenant Yule estimated that the cost of conveying to Pondua, by his proposed plan, 100 maunds of Coal, would be Rupees 22.778. To this add the cost of freight to Calcutta at least Rupees 21 per 100 maunds ; and the cost would be Rupees 43.778 per 100 maunds in Calcutta. In this estimate no allowance is made for cost of storage, and re-loading at Pondua.

Further, there is no charge in this estimate for the cost of original construction of the road and inclines, nor any interest on the outlay calculated. For the mere cost involved in repairs, wear and tear of machinery, &c., I conceive that at least 10 per cent. on the outlay should be charged, independently of the interest on the capital invested. Taking this as low as 15 per cent., there must be added to the cost, as estimated by Lieutenant Yule 15 per cent. per annum on the original outlay of Rupees 66,584. Or, what will come to nearly the same thing, we must consider this capital, or original cost, as to be repaid in not more than seven years ; or that to the annual cost there should be added the seventh part of the original outlay, or Rupees 9,500. This sum should of course be divided over the whole amount sent down. If we estimate this amount as not less than 200,000 maunds, this would add to the cost per maund, as calculated above, 0.76 of an anna. Or if only one-half this quantity (100,000 maunds) were sent down, it would increase the cost per maund by 1.52 anna per maund.

Taking however the more favourable estimate, of the larger quantity, it results that on Lieutenant Yule's plan the cost per 100 maunds in Calcutta would be Rs. 43,778 × 047 = 43,825, or per maund 0.438 of a rupee, equal to 7 annas 10 pie per maund.

Even, therefore, estimating on the larger quantity taken above, and without any allowance, as I have stated for re-loading at Pondua, the actual saving is only 6 pie or one-half of an anna per maund ; or in British money one shilling and nine pence per ton.*(a)* I should state, that I have above taken the cost

*(a)* Supposing that the whole quantity above calculated for, were sold in Calcutta at 8 annas per maund, thus producing Rupees 100,000, while the difference in the cost of transport would be Rupees 6,250, this would give an additional profit of £ 6-5 per cent.

per 100 maunds, as calculated by Lieutenant Yule for 100,000 maunds, and that he supposes that this cost (*viz.* Rupees 43,778) would be reduced to Rupees 41,942 per 100 maunds, were the quantity increased to 200,000 maunds, inasmuch as the "expense of establishment for the railed descents" would remain constant. But I have done so for this reason, that in none of his calculations has Lieutenant Yule estimated for the Cost of the trucks in which he proposes that the Coal should be conveyed.

His calculation as to the quantity of Coal which could be readily conveyed down his proposed inclines is as follows : "supposing each truck to measure "four feet in length, by 2-3 in breadth, and 1-3 in depth, three such trucks "would carry down 30 maunds each trip, and supposing only six trips in the "hour, we might thus convey 180 maunds per hour, 1,800 per day, or 54,000 "per month."(*a*) Now for such work, at the least, there would be required an establishment of 250 trucks,(*b*) which would require for their construction and repair a considerable outlay. And this consideration justifies, I think, my having taken above the higher estimate of the cost per 100 maunds.

At the same time I am perfectly satisfied that on other grounds, altogether, a mixed system of ordinary cart-roads, and of railed inclines would be found impracticable. The trucks which Lieutenant Yule proposes would be useless on ordinary roads, while ordinary carts would be equally impracticable on the railed descents. The entire distance must therefore be *railed*, and the trucks travel throughout ; and this would be decidedly the best plan : or, the Coal must be shifted at the top and bottom of each inclined plane from the trucks to the carts, and from the carts again to the trucks. This would involve six loadings and unloadings of the same coals, and the waste consequent thereon : quite sufficient, in my mind, to prevent the adoption of such a system of work.

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*(a)* This supposes 10 hours unbroken work in the day, and 30 day's work in the month ; which is certainly above the average amount that could be obtained.

*(b)* Supposing each truck to make two trips in the day, up and down, (or to require for loading, despatch, descent, and unloading, and return to the mines, five hours) there would be constantly in work at the same time 90 of these trucks. The entire distance by Lieutenant Yule's measurements is nine miles, and 702 yards; or for the double trip 18¾ miles. This distance could certainly not be travelled in less time than I have calculated, *viz.*, 5 hours.

I conceive, therefore, that this plan of accomplishing the distance partly by ordinary roads, and partly by railed inclines is quite impracticable : and Lieutenant Yule has himself shewn that the cost of transport by a continuous cart road, with gradients adopted to the use of ordinary carts, would be greater than the cost under the present system of coolies. And this independently of any consideration of the cost of constructing such a road.(*a*)

In the preceding part of this report, I have briefly described the mode of occurrence of the Coal-bed at Cherra Poonjee, its thickness and its accompanying rocks. I have also alluded to the irregularity of its development. and to the presence of this character at all the points where Coal has been observed in the Khasi hills. It still remains to estimate, as fairly as can be done under these conditions, the quantity of Coal existing in the Cherra ridge.

The importance of this consideration has been most justly and forcibly alluded to by Lieutenant Yule in his report. He says "in deciding on the "propriety of executing any work for facilitating the carriage of the coal, the "first question which rises naturally is, whether the Cherra seam is sufficiently "extensive to justify entering on any measure of the kind. After having "expended many rupees in making the Coal Mine more accessible, it would be "awkward to find that the Coal also had been expended in the meantime. I "have done as much to ascertain the extent of the seam, as could be done with-"out going to a much greater expense than would have been justifiable without "special orders on the subject. And I have connected the points at which I "know Coal to exist by a sketch. There is, I think, no reason to doubt that all "these points are portions of an uninterrupted bed of Coal ; and taking this "for granted, I calculate the quantity of Coal in the ridge with an average "thickness of five feet to be 50,000,000 of cubic feet, or about as many maunds."

I have given his words in full, because although I feel satisfied, from the care which he obviously devoted to the investigation of the questions referred

(*a*) There is a serious objection to this plan, arising from the extremely wet climate. The greater part of such roads should necessarily be paved with stone, to preserve them; and constant travelling on such paved roads, would very soon knock up any bullocks.

to him, that he was justified in adopting such a conclusion from the facts that came before him, I have been myself compelled to form a very different estimate. By a reference to his map, the three points referred to by Lieutenant Yule are seen, but after a careful examination of the ground between, I can say, that, so far from there being an uninterrupted bed of Coal uniting these points, the greater portion of the district between them is altogether without coal. And I believe that an estimate of one-third of a square mile of Coal with an average thickness of from 3 feet 6 inches to 4 feet, will be rather over than under the truth. This would give in round numbers from 10,850,000 to 12,400,000 cubic feet, or as many maunds,(*a*) or from 387,000 to 447,000 tons.

In connexion with this point and as a curious instance of the difficulty of arriving at accurate results, in such matters, I may briefly state the various amounts of thickness which have been assigned to this Cherra Coal. By Mr. Cracroft in 1832,(*b*) it was stated to be six feet six inches, divided into 3 layers: by Colonel Watson(*c*) in 1834, January, to be from 10 to 16 feet · by the same gentleman in the same year, but a few months later, as, from 16 to 20 feet :(*d*) In 1837, in the first report of the Coal and Mineral Committee(*e*) it is given as "15 feet in places," and in their last report published in 1846 it is stated to be 28 feet.(*f*) And in a short paper communicated to the Geological Society of London, through Mr. C. Lyell, Dr. MacClelland gives its thickness as "above 20 or 30 feet."(*g*) This great difference in statement no doubt arises in a great degree, from the extreme looseness with which such assertions are commonly made, as when a bed of Coal is stated to be of 20 or 30 feet in thickness (a difference in thickness of 10 feet being apparently considered perfectly immaterial,) but I am inclined to think that in the present case, it

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(*a*) This amount would not supply the present demand in Calcutta, for Burdwan Coal alone, for more than four to five years, without taking into account at all the prospective increase of this demand; or the large quantity of imported Coal used. Or, taking Lieutenant Yule's estimate of the amount capable of being sent down, viz. 54,000 maunds a month, the whole would be exhausted in 16 to 18 years.

(*b*) Journal Asiatic Society Bengal, Vol. I.

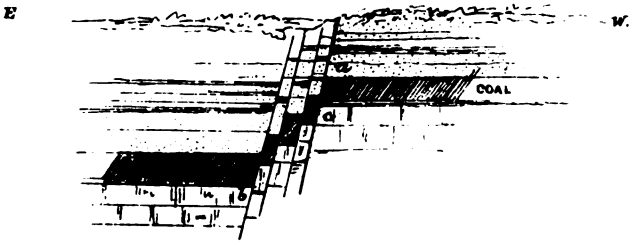
(*c*) Journal Asiatic Society Bengal, Vol. II., p. 25.

(*d*) Journal Asiatic Society Bengal, Vol. III., p. 142.

(*e*) Page 31. (*f*) Page 127.

(*g*) Proceedings, Geological Society, London, Vol. II., p. 567, June 14, 1837.

has in some degree arisen from another circumstance to which I have referred above, namely, that at the part of the hill in which this Coal was first examined there is a fault (or rather two or three small faults combined) which has an up-throw to the West of about 40 feet. It would be very easy to be led astray in estimating the total thickness of the Coal in this immediate spot : and it is I think very probable that some of the observers measured the distance between the bottom of the Coal on one side of these disturbances, and the top at the other side. A glance at the accompanying Sketch will explain this. This Sketch though not intended to represent the exact conditions of the case, will explain the possibility of being misled in a hasty examination.




The bed of Coal is here represented as broken up and dislocated by four small faults, which are all up-throws to the West. If then this portion of the section be partially concealed by fallen detritus, it would be very likely that the space between *a* and *b* would appear to a hasty observer the thickness of the bed of Coal, although the actual thickness is only from *a* to *c*. In this way a bed of only five or six feet thick might assume an appearance of being 20 or 30 feet thick.

In the foregoing estimate I have confined myself entirely to the Coal found in the small ridge to the West of the station of Cherra Poonjee, and in which the adits hitherto worked are situated. The Coal which occurs at the village of Lairungoo or Surareem is, from the greatly increased distance and increased elevation (some 700 feet), entirely precluded from being profitably brought to market under present conditions, while the small patches of Coal which shew on the road between Cherra Poonjee and Surareem, are too limited in extent, too much disturbed, and too poor in quantity to be worth considering at all.

The Coal at Bairung has proved very bad, and earthy, and is in small quantity; and although possibly useful for lime-burning, brick-making or other such purposes, would not yield any Coal, which would repay the cost of transport to market.

The Coal which is found to the South of *Nonkradem* is more favourably placed than any of the others, but from the way in which it is seen, it would be impossible to form any opinion as to its extent, without expensive boring operations.

I have in a former report, described in detail the mode of occurrence, amount and quality of the Coal at Lakadong, to the East of Cherra Poonjee.

The season of the year, and the consequent very unhealthy state of the swampy jungles at the base of the hills, entirely prevented my visiting the various points to the Westward of Cherra Poonjee and towards *Laour*, where Coal is stated to occur; so that I can offer no opinion whatever as to the quality, or amount of Coal. If the statements regarding the occurrence of thick beds of Coal in this direction at slight elevations above the level of the plains be credible, this district would reward a careful examination. It could only be visited with any safety, during the cold weather. If Coal exist there in any quantity, the probabilities are that it would be found to be very similar to the Coal of Cherra Poonjee, in quality. And independently altogether of the statements of observers, the general dip or inclination of the rocks, with which the Coal is associated, (and to which I have alluded before) renders it tolerably certain that it must occur at a considerably lower elevation than the Coal near to Cherra Poonjee.

I have not entered into the question of the possibility of bringing these Coals *profitably* to market; nor did I feel justified in devoting any of the short time at my disposal in these hills to the investigation of any engineering projects for this purpose further than was necessary for ascertaining the comparative economy of the various plans hitherto proposed. I was satisfied that any mixed system of transit, partly by ordinary conveyances, and partly by machinery, would fail. I was also satisfied that *no one* of the localities referred to, held out a prospect of sufficient Coal to yield a fair return on the outlay required for such works for its conveyance. But at the same time I was convinced that

were all these localities in the possession of the same persons, possessed of sufficient skill and energy and who would work each in succession (the needful machinery for such operations being transferred from one site to the other) that it would be possible to render the undertaking a profitable one.

Into the details of any such plan it is not my province to enter; but I am certain that a little experience in the more economical systems of recent mining operations would suggest much more simple and less expensive plans of operation than have been proposed with reference to Cherra Poonjee.

Nor does it at all come within my subject, to discuss the probability, or improbability of such prices being obtained for this Coal, as would yield a profit on its working. The changing condition of the markets; the ever-varying charges for freight, &c., of imported Coals; and the constant alterations in the amount of demand and other considerations, all so materially affect the question of profit on such undertakings, that any opinion formed on an imperfect acquaintance with the general commerce of the country would be of little value. I have therefore purposely confined my observations to an examination of the mode of occurrence of the Coal, its extent and character; the cost under existing arrangements for conveying the Coal to market, and the schemes which have been proposed for its more economical transport.

The quality of the coal at Cherra has been so frequently spoken of, and written about, as being "greatly superior to the Burdwan" (in the ratio of 12 to 10, or even of 5 to 4, it is said) and as "being fully equal in every respect to English Coal," that it may be desirable to give a word of caution on this subject, lest some might be misled by such loose statements. The Cherra Coal is undoubtedly superior to the Coal from the Damoodah valley; and to the average of that Coal, as it has been hitherto supplied to the Calcutta market, after nearly two years' exposure, it is probably superior in the ratios mentioned before: and it is equally certain that it is equal to *some* English Coals, but it is as certainly inferior to others. It is *quick in its action* and therefore would

generate steam rapidly : it cakes well but gives out a large amount of smoke: it is fragile and easily broken, and from the absence of that definite structure, which produces the planes of division known to English miners, as "backs" or the joints in the Coal, it breaks into unsymmetrical pieces, and consequently would not stow well. From its composition(*a*) therefore, its quick combustion, and its irregular cleavage, I conceive it to be at the least 5 to 7 per cent. inferior to *good* English Coal. As a gas-producing Coal, it is superior to any English Coal imported, both as regards the quantity and purity of its gas. And with proper precautions in burning, it would yield a very passable coke.

But further, as regards any extensive or systematic working of these mines, there is a condition at present attached to the authority under which they are held, which, if continued in force must effectually prevent their being economically worked. I allude to the clause in the lease, by which the lessee is prevented from interfering with any of the subjects of the Cherra Rajah, who may extract Coal on their own account. So long as such be the case, no general system of operation could be adopted, and no general arrangements for the ventilation, and security of the mines could be carried out, as these would be constantly liable to interruption, at the caprice of any unskilled Khasi, who might fancy to work in one part of the hill in preference to another. In fact, almost all the Coal hitherto sent down from these mines, has been purchased from such Khasi merchants, who have raised it and sold it. And on a very few maunds, indeed, has the prescribed royalty of 1 Rupee per 100 maunds been paid by the Government, or its representatives to the Cherra Rajah, as very few maunds have been raised by persons in their employment. Just at present, while the Coal is easily accessible, it can be procured in this way as cheaply, if not more cheaply, than if men had been paid to hew it; and the royalty paid on the quantity extracted. But such indiscriminate and

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*(a)* By Mr. James Prinsep's analysis, the composition of Cherra Coal was water 7·0, volatile matter 37·1, carbon 62·0, ash 0·9 : while the *average* quality of good English Coal imported was volatile matter 31·0, carbon 67·3, ash 1·6. In a rude way these Coals may be taken to vary in value in the ratio of the different amounts of carbon contained, or that Cherra Coal is to English Coal (average) as, 62: 67·3.

unsystematic working entails an enormous waste of the Coal itself. And no precautions being taken to keep open the mines, or to support the rocks above the Coal, after these workings have been extended a little, all will come in, and mines and miners be buried in one common grave.*(a)*

There is no such restriction affecting the mines at Lakadong, which are the property of Government, the whole of the Jynteah hills, in which they are situated, having passed into the hands of the Indian Government, together with all the rights to mines, jungles, &c., previously held by the Jynteah Raja, who resigned all claim to them in 1835.

On the other hand, the Coal which is found to the South of Nonkrâdem, is in the territories, and under the control of Singh Manick, the Kyrim Raja, who is still independent.

I fully anticipate, however, that the Coal of Cherra Poonjee, and of this frontier generally, even though it may not be possible to bring it with profit to the Calcutta market, will turn to great and useful account at some future, and not very distant period. I do not think it probable that the extensive districts of Sylhet, Cachar and Munnipore, (with the prospect of an increasing traffic

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*(a)* The lease referred to above is in the following terms:—"To the Political Agent, Cossiah hills, Cherra Poonjee. I, Soobah Singh, Raja of Cherra Poonjee, hereby give a perpetual lease to the British Government of the Cherra Poonjee Coal-beds, now being worked, situated within my territories, known by the names of Oosdir, Ooskan and Nonkreem hills. The terms of the lease, mentioned in the following paragraphs, are to be considered final and binding.

"1st. I am to receive for all Coal mined by Government servants at the above places, 1 rupee for every 100 maunds. I will on no account demand more. The Government are not to prevent my own subjects from working on their own account at the above mines; and such of my subjects as do so will settle and pay to me direct for all Coals they may mine at the above beds. The Government have the power, however, to prevent others than my own subjects from mining at the above places, without their previous sanction and order.

"2nd. The above terms to be held good for a perpetual period. I will on no account ask for any new arrangement to be made.

"3rd. Should at any future period any new Coal-beds be discovered within the limits of my territories, I hereby agree to make them over to the British Government on the above terms." Dated 20th April 1840.

The lease granted by Beera Singh and Ram Roy, Cossiah Sirdars of Bairung Poonjee, and confirmed by Sooba Singh, Raja of Cherra Poonjee, was in all respects similar, and bore the same date. It granted the right to work the Coal at Bairung.

from the East along this valley) can be much longer deprived of the benefits of steam communication. The noble river, Soorma, stretches in one continuous course throughout the entire distance, and is navigable for steamers of the ordinary size without the interruption of a single dangerous spot, and at all seasons, as far as *Chattuc*,(a) while ordinary boats of considerable size can proceed as far as Silchar, and smaller boats much further. This unbroken line of water-communication, stretching for more than 350 miles from Calcutta, seems specially adapted for such an enterprise ; and if once a steamer communication be opened along this river, the Coals of the frontier will prove highly valuable for the supply of the requisite fuel, at an economical rate. There may not be at the present a sufficient trade in this direction to render such a project remunerative ; but this was equally the case in other localities, and there can be little question that any increase in the facility and rapidity of communication with these districts must tend to develope new sources of trade and to extend the existing ones. Moreover, such a system of inter-communication would appear to be especially desirable in a district where every road is covered with water for some months in the year and communication can be maintained only by boats.

I have on a former occasion(b) referred to a great superiority of the Cherra Goal, over other Indian Coals for the manufacture of gas : should such a source of gas ever be employed in this country.

*Iron*. The manufacture of iron appears to have been carried on in these hills from time immemorial ; and by all the tribes inhabiting them. Very soon after the British occupation of the Khasi hills, this manufacture attracted attention. In a short notice of these hills,(c) in 1829, it is referred to ; and in the same year Mr. Jones writing of the mineral productions of Bengal,(d) recommends Pondua at the foot of these hills, as an excellent site, for an iron

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(a) A rapid, passable however during one-half of the year, prevents steamers from proceeding further than Chattuc.

(b) Report on Lakadong Mines, Oct. 24th, 1851.

(c) Gleanings in Science, Vol. I, p. 252.

(d) Gleanings in Science, Vol. I, p. 281.

mill, for the manufacture of bar, bolt and hoop iron. Mr. Walters(*a*) in his account of a trip across these hills, refers to this manufacture, and gives a rough sketch of the furnaces in use for smelting. A few years later, Lieut.-Colonel Watson detailed the circumstances which appeared to him to render Cherra Poonjee a favorable site "for the erection of an iron and steel manufactory on an extensive scale."(*b*) And still more recently Lieutenant Yule published a very good account of the processes adopted in washing and smelting the ore ; and the manufacture of the iron.(*c*) Mr Cracroft(*d*) had 10 years before described the same processes, though not so fully, and had published a sketch of one of the Khasi furnaces for smelting, in operation.

The system at present followed in these hills, both in the extraction and washing, and in the subsequent smelting of the ore, being precisely the same as 20 years since, it will be quite unnecessary to do more than refer to the papers quoted above, for a description of the details of the several processes.

The principal sites of the mining operations within the Khasi hills, are near Molim, Nonkrim, Lailangkot, &c., on the granite district of that neighbourhood ; and more to the West near Lungkoi. In other places, where no washings for ore are now carried on, the enormous blocks of granite strewed over the surface, and piled up in gigantic masses, bear evidence to the former existence of workings, of the magnitude of which they remain the lasting monuments. The richest portions of the washings have been generally on the outskirts of the granite area, or near its junction with the rocks that rest upon it.

The only ore worked in these hills occurs in the form of a fine sand consisting of minute crystals of titaniferous magnetic oxide, which are irregularly distributed in the mass of the softer portions of the granite rocks, and also occasionally in some of the gneissose beds. The upper portion of the granite

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(*a*) Asiatic Researches, Vol. XVII, p. 499, published in 1832 ; excursion made in 1828.

(*b*) Journal Asiatic Society, Vol. III. p. 25, January 1834.

(*c*) Journal Asiatic Society, No. CXXIX. p. 853, 1842.

(*d*) Journal Asiatic Society, Vol. I. p. 150, 1832.

is partially decomposed to a considerable depth, and this soft, and easily yielding rock is not quarried, or mined, but simply *raked* into a small stream of water conducted along a little channel formed at the base of the small scarp, or face of rock, from which the ore is obtained. The process of washing is carried on precisely as Mr. Yule described it in 1842. The manipulative skill of some of the Khasi women, acquired by long practice in these operations, is very great ; and a very small proportion of the ore is lost in the washing.

With very few exceptions this ore is not reduced or smelted in the villages, adjoining which it is procured. It is sold in baskets of a tolerably fixed size and shape, seven of which contain about three maunds of the ore. It is carried, often for many miles, to the villages where the smelting furnaces are situated. In most cases the crude iron as it comes from the smelting furnaces, is again brought to market, and carried to other villages where it is manufactured.

By much the larger portion of this *cutcha* iron, in the balls or lumps in which it comes from the smelting furnaces, is sent to the plains, where it meets a ready sale. It is brought on the northern flanks of the hills to the several marts in Assam, and on the southern, to Pondua, Lacat, Chattuc, &c., where it is purchased in large quantities, and chiefly, or at least, very largely used in the manufacture of the double hook-like nails, with which the planks of boats are united ; and for which there is a great demand at the large boat-building villages on the Soorma River (Azmerigunj, Beetalung, &c.)

Of the iron, which is converted within the hills, the greater portion is wrought into codalees (or the native form of shovels or spades), or into the large chopper-like knives or *dhows*, which the Khasis use.*(a)* In all such manufactures there is a nearly complete division of labour ; the making of each being confined to different individuals and generally even to different villages.

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*(a)* This *dhow* is a straight cleaver-like knife, one edged, from 12 to 15 inches in length, and set in a handle of 10 to 12 inches long. In a Khasi's hands, it is an effective tool, and forms his chief weapon, offensive and defensive, his axe and his knife. Fortunately, of late years, it has been used almost exclusively in the felling of trees, &c., and ordinary labour.

The manufacture of codalees is carried on extensively in some villages, differing entirely from the huts in which the first smelting or reduction of the ore is carried on. Those in which this manufacture is conducted are generally open sheds, of an oblong shape, the fire being placed at one end. Under this rough cover, formed simply with poles supporting a roof, five men are engaged ; one sits at the end of the shed, on a sloping bank, behind the hearth, and works the bellows, with his feet. Another superintends the fire, and directs the operations. One of the divided lumps, into which the smelted ore has been made, is then placed in the fire, and being thoroughly heated, to a good red heat, it is roughly but rapidly reduced from its semi-circular form into a more regular and bar-like shape. It is now again fired, and when heated, is with a single forcible blow united with the small piece of iron, which is to form the handle (Fig 1) and which has been previously roughly formed. Re-heated, it is then beaten out into the first form of the codalie (Fig. 2). It is again heated and an additional change of form given to it. The mass which at first was about 2 inches thick has now been reduced to about ½ of an inch, or thereabouts ; and, about 4 inches wide at first, it has now become seven or eight. Another heating again reduces

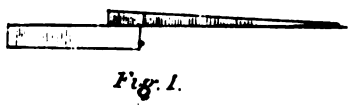


Fig. 1.

Fig. 2.

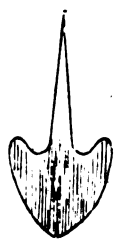
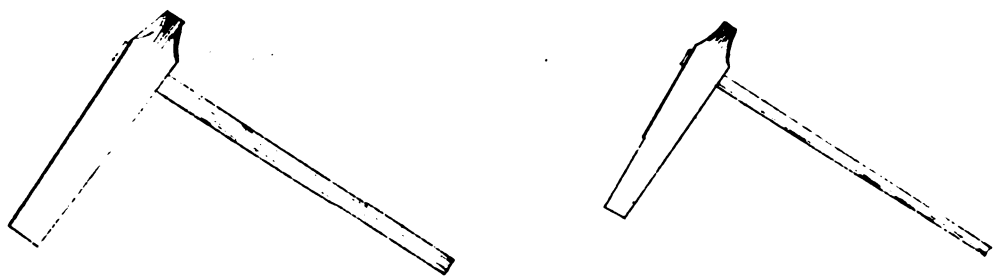


Fig 3.

this, and gives it more form. This is the fifth time it has been fired, and it is again heated three times more, and each successive time, brought more nearly to its finished state. Up to this, the four men have been all engaged in the forging ; now the one man, who has charge of the fire, singly continues to improve the form and complete the fashioning of the codalie.

The hammers used by these smiths, appear at first sight very awkward and unwieldy. They are very long in the head, being from 12 to 17 inches, only one faced, and with the handle inserted near to the end of the head. This handle is frequently not much longer than the head of the hammer itself. This peculiarity in the forms of the hammers used leads to a marked difference in the mode of using them, as compared with that which an English mechanic would adopt. A Khasi smith never swings his hammer, however heavy, but simply lifts it vertically, and the force of the blow depends on the weight, and impetus of the hammer itself as it falls, rather than on the muscular power of the person who wields it. The general form of the hammers used by the Khasi smiths is shown below. Few of these exceed 6 lbs. in weight.



The anvil on which the work is carried on, is simply a rounded block of the hard granite, found in the adjoining district, and the ring of the hammers on the stone as each successive blow is given, produces an extremely musical effect, and at a little distance sounds like the chiming of melodious bells.

The fuel used is entirely charcoal, soaked in water, and kept in a large earthen basin-shaped place next the fire.

The pig iron, as described by Lieutenant Yule, is produced from the smelting furnaces in nearly circular lumps or balls, which are subsequently split or divided into two parts. Each of these blocks or balls makes two codalies, or each half ball will make one. Each of these balls weighs on an average seven seers, while each codalie weighs not quite two seers. From this it follows

that the loss or waste in the manufacture of a codalie, which weighs not quite two seers, is one seer and-a-half, or nearly 75 per cent., a most convincing proof of the impurity of the iron as it comes from the smelting furnaces.

The ordinary out-turn of one hearth, or the labour of five men per day, is 10 codalies. The pig-iron is sold at the rate of six to eight blocks for 1 rupee, and the codalies sell for about $3\frac{1}{2}$ annas each, or five for a rupee.

After being formed, and worked-up, while hot, all these codalies are thoroughly cold hammered and finished on a smoothly-polished stone anvil. This portion of the work is done by the three men who are not engaged at the fire in the forges during the short intervals of labour, while the mass of iron is being heated, or when their services are not required in the forging of the heated mass. And after finally being finished, as far as the forging is concerned, the codalies receive a rough kind of semi-polishing, or brightening, which is accomplished in a most ingenious way. They are carried in numbers by the women or young girls to the bank of some adjoining stream. A common handle is procured, into which each codalie is successively inserted, and then it is for a few minutes rapidly driven into the moist sharp sand of the river. This acts precisely as a grindstone, the sharp-cutting edges of the small quartz grains in the sand soon giving a clean and smooth surface to the spade.

A large number of these codalies is annually sent from the hills into Assam, in addition to the quantity required for the supply of the Khasis themselves. But I was informed that even in the vicinity of the hills, English manufactured spades could be purchased at as low a price, as these hill manufactured tools; and were of a superior quality, being more durable.

The quality of this Khasi iron is excellent for all such purposes, as Swedish iron is now used for. The impurity of the blooms, however, as they are sent to market, is a great objection to its use; and the waste consequent thereon renders it expensive. It would also form steel or *wootz* of excellent quality. I have no doubt that the manufacture could be greatly improved, and

possibly extended. The great defects in the present system are, the want in the first instance of a means of sustaining a sufficiently high and equable temperature in the hearth, so as to keep the whole of the mass or bloom of metal in a molten state at the same time, and thus more completely separating the slag from the purer metal; and, of some more powerful means of expressing the slag from the spongy metallic mass than the slight hammering it now receives with a wooden mallet, or club.

But I do not think (judging of course from the portion of the hills I had myself an opportunity of visiting) that the manufacture of this iron could be very much extended, owing to the scanty dissemination of the ore in the rocks, and the consequent high cost of obtaining it. At present the want of any permanent supply of water prevents the natives from working for more than a few days during the year, while the rains are heavy, and they can readily obtain sufficient force of water for the washing of the ore from its matrix.

I would here mention, that although I have never heard that any gold has been observed during the washings for the iron ore, when if it occurred in any quantity, it could scarcely have escaped notice, still, on amalgamating a large amount of this ore, or rather on agitating it in contact with some mercury, I obtained distinct traces of gold although in very minute quantities; quite too trifling to admit of its profitable extraction. It is more than probable than in some other localities it may be found to occur more plentifully, and that these hills, or the continuation of the same ridge to the eastward, may prove to be the source of some of the gold found in the rivers of the Assam valley.

There are some other branches of traffic carried on by the Khasis which we shall just mention, although not coming within the limits of our investigation.

A large quantity of *potatoes* is annually sent from these hills. And this trade gives occupation to hundreds of coolies during the months of September and October, and to many families in the cultivation. For the most part, these

potatoes are purchased in small quantities from each family by Khasi merchants or by Bengalees who come up for the purpose, and the accumulated store is then shipped from Pondua or Chattuc to Calcutta.

From these hills also, Calcutta and other places are principally supplied with *pine-apples*. They grow freely along the lower slopes of the hills, and are of good quality, but I am satisfied capable of being greatly improved were a little more care devoted to their culture. The same plant furnishes the Khasi with the strong and smooth fibre of which his netted pouch is made, and which is usefully applied in a thousand other ways.

But the quantity of pine-apples despatched from this frontier is nothing as compared with that of *Oranges*. Of this fruit immense numbers are annually sent to Calcutta and other places. They ripen towards the end of October and in November. The fruit is small, roundish, with thin rinds, and like the variety so well-known at Malta under the name of the Mandarin orange. The orange groves stretch for miles along the flat ground just at the base of the hills, and are very well kept, and constantly renewed. The fruit is the only product of the trees here economized. The manufacture of orange flower water which in the South of Europe is so extensively carried on, and which there forms a source of very considerable profit (so much so, that I believe many extensive orange plantations are employed for this purpose alone) is here unknown. The use of this luxury, if it were obtainable at a small cost, would surely become widely-spread in a climate like that of Bengal; and I am disposed to think the manufacture of it might be very profitably introduced.

Such is a brief sketch of the various products obtained from the Khasi hills, and of the purposes to which they are applied. And if this outline should lead to further investigations, and tend to direct the attention of any to this district, and so increase the number of its visitors, I am satisfied, that whether profit may be derived from such investigations or not, much pleasure will result from a sojourn amidst the most lovely scenery, and among a people presenting many interesting points for study, and many excellent traits of character; and in a most salubrious climate.

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# APPENDIX.

# APPENDIX A.

## *Elevation above the Sea of various localities in the Khasi Hills.*

| | Feet. |
|---|---|
| Cherra Poonjee, ... ... ... | 4118 |
| Kala-Pani (Bridge), ... ..... | 3179 |
| Boga-Pani (road near Bridge), | 4451 |
| Mowphlang, ... ... ... ... | 5931 |
| Soh-iong (Syung Bungalow), ... | 5355 |
| „ (Native Village),..... | 5901 |
| Mairung (Bungalow), ... ... | 5537 |
| Nungklow (Bungalow), ..... | 4585 |
| Bori-pani (below Nungklow), level of Suspension Bridge, ... | 2380 |
| Bori-pani level of water, ..... | 2339 |
| Shillong Hill, ... ... ... ... | 6124 |
| Maum'luh, (gate of Village), ... | 3852 |
| Mahadeo (Rock), ... ... ... | 2623 |
| „ (Guard House), ..... | 2188 |
| Tungwai (Village), ... ... ... | 210 |
| Bairung, ... ... ... ..... | 1242 |

| | Feet. |
|---|---|
| Kullong rock, (top of) ... ... | 5684 |
| „ level of top of Teelahs to the South of the Rock, | 5210 |
| MonaiVillage on road to Kullong, | 5067 |
| Laidom, ... ... ... ... ..... | 5205 |
| Lailangkot, ... ... ... ... | 5703 |
| Nungkrím, ... ... ... ..... | 5406 |
| Pomrong, ... ... ... ... ... | 4748 |
| Kala-Pani, (ridge to south of)... | 5300 |
| Joowye (Jynteah Hills,) ..... | 4230 |
| Mentedoo River (at ford on road from Joowye to Lakadong,) ... | 3845 |
| Rombai, ... ... ... ... ... | 3578 |
| Oomsatung, ... ... ... ..... | 3234 |
| Lakadong,... ... ... ... ... | 2294 |
| Mooshye, ... ... ... ..... | 3411 |

The following are elevations of places of minor importance, determined for geological purposes:—

| | |
|---|---|
| Top of Greenstone seen under Maum'luh, ... ... ... ... ... ... ..... | 3222 |
| " Jasper beds," ... ... ... ... ... ... ... ... ... ... ... ... ... | 2384 |
| Level of " Fossil beach" of Dr. MacClelland, under the village of Maum'luh, (" Cyrtoma" beds,) ... ... ... ... ... ... ... ... ... ... ..... | 2974 |
| Level of Fossil beds, above Teriaghat, ... ... ... ... ... ... ... ..... | 352 |

| | |
|---|---|
| Teriaghat, above sea, ... ... ... ... ... ... ... ... ... ... ... ... | 128 |
| Top of Metamorphic rocks to South end of the Cherra Valley, ... ... ..... | 2155 |
| Ditto ditto ditto, three miles further to the North, ... ... ... ... ... ... | 2913 |
| Living Bridge, near junction of the valley of Temshung and Mawsmai, ..... | 977 |
| Bamboo Bridge, about three miles to the North in the same valley, ... ... | 2311 |
| Maw-ring-rin, (three large stones on ridge North of Cherra), ... ... ..... | 4823 |
| Top of Waterfall, (North end of Cherra Valley,) ..... ... ... ... ... ... | 4860 |
| Level of Assam Road, at small toll house North end of Cherra Poonjee Native village, ... ... ... ... ... ... ... ... ... ... ... ... ..... | 4428 |
| Native village of Cherra Poonjee, ... ... ... ... ... ... from 4397 to | 4572 |
| Bottom of zig-zags, on road to Teriaghat, ... ... ... ... ... ... ..... | 1428 |
| Level ground below ditto, sandstone abounding in shells, ... ... ... ... | 750 |

The above elevations have all been determined from observations made with a mountain Barometer of Newman's latest construction, and obtained from the Mathematical Instrument Department, Calcutta, and observed synchronously with another stationary at Cherra Poonjee. The elevation of the Bungalow which I occupied there (in 1851), was obtained from the average of 112 observations, synchronous with those made at the Surveyor General's Office in Calcutta: the instruments used in my observations having been carefully compared with those in Calcutta, and reduced to the same standard.

The elevation of this point at Cherra Poonjee, having been thus established as 4118 feet above the level of the sea, (or above the datum determined for Calcutta, namely 18.11 feet below the cistern of the Standard Barometer there), the elevations of all the other localities have been determined by adding, or subtracting from this ascertained height, the difference of elevation due to the different readings of the Barometer. This has been done in preference to comparing each observation with the Calcutta readings as being much more likely to afford correct results. The greatest elevation, deduced from the Cherra observations was 4144 feet; the lowest 4065.

# APPENDIX B.

## *On the Climate and Meteorology of Cherra Poonjee.*

THE peculiar position of Cherra Poonjee, situated on the summit of a highly-elevated ridge which rises rapidly, and (in this portion of the range,) almost perpendicularly, from the great expanse of the plains of Bengal, with no great extent of ground behind it of greater elevation, and almost encompassed by several great glens or valleys which enter the hilly range and stretch up to the very foot of the small plateau on which the station is placed, would in itself have pointed it out as a locality, likely to afford valuable opportunities of observation to the meteorologist. And the few detailed statements which had already been published by persons resident there, more especially with regard to the amount of rain, (some of which appeared almost too extravagant for belief) fully confirmed this view. On visiting the hills therefore, I determined, as far as other pursuits would permit, to keep up a regular series of observations during the time of my residence there, and after some consideration I determined also to adopt the ordinary and regular hours for observation, namely, at 3 A. M., 9 A. M., 3 P. M., 9 P. M., apparent time, and also to make a series of hourly observations on the established term days (the 21st of each month) when it was possible.

On my first arrival, however, in the Hills, several circumstances combined to prevent my being able to commence this series of observations immediately. I discovered a leak in the rain gauge, which I could not get immediately repaired in an out-of-the-way station, where braziers did not abound ; and a convenient and suitable locality for placing the instruments, had to be prepared. Owing to these circumstances, I did not commence the regular series of daily observations until the 1st of July, although I was able to obtain a series of hourly observations on the 21st of June.

The value of such records depending entirely on the accuracy of the instruments as well as the care and regularity with which the observations have been made, a brief description of the instruments used will be requisite.

The Barometer employed in all the observations here recorded was an excellent mountain Barometer (numbered 84) of Newman's construction, mounted in a bronze case and reading with the aid of a Vernier to the $\frac{1}{500}$ of an inch and readily by estimation to the $\frac{1}{1000}$. This instrument was carefully suspended at the distance of one foot from the northern wall of the Bungalow in which I resided, and at a height to the level of the cistern of three feet two inches and a half.

This Barometer was one of two supplied to me from the Honourable Company's Stores in Calcutta, and at my request had been carefully compared for some days with the Standard Barometer used at the Surveyor General's Office, Calcutta, in the series of observations regularly carried on there. I regret exceedingly to add that the index error if any, of that standard, as compared with the English standard, is not yet known, but this deficiency, will in all probability be soon supplied, and then whatever correction may be required can readily be applied to the observations here given. This remark will apply also to the Thermometer readings given here. The index error of the Barometer used, as compared with the Calcutta standard, would appear to be —. 023.

And this correction has in all cases been applied, so that all the Barometric observations here given have been reduced to a common standard or datum, with those recorded for Calcutta. The Thermometer used for the temperature of air was also of Newman's construction and with a brass scale divided to half degrees and of such size as to admit of estimating to $\frac{1}{10}$th of a degree by a practised eye. It had also been compared with the Standard Thermometer used in the Calcutta observations, and the resulting index error appeared to be —. 339. This correction has *not* been applied: being small, it does not much affect the results given, and I have hesitated to apply it the more because on comparison with some Thermometers, which I had brought out from England, (the value of which I knew and which had been by comparison found accurate,) I did not find that they agreed sufficiently, and that correcting this Thermometer to agree with the Calcutta standard, would, if my own instruments were correct, be only making the readings further from the truth. I have therefore simply brought all the Thermometer readings to the same standard or datum, being for this series of observations —. 339 less than the Calcutta standard.

With regard to the Hygrometric observations, not being able to procure a Wetbulb Hygrometer in Calcutta, I was obliged to use a Daniell's Hygrometer for some days until I could make up a "Wetbulb" with some Thermometers I had, and it will be seen on reference to the tables that up to the 22nd of July, Daniell's instrument was used: subsequently to that date I used a Wetbulb arrangement, which I had constructed with two

thermometers with brass scales, which I knew from some years' experience agreed perfectly in the scale, and which were very accurate in their divisions.

The maximum and minimum Thermometers used were of the ordinary construction. They were instruments constructed by Newman, London, and as compared with the Calcutta standard, the maximum read + ·530 the minimum read —1·450. But here also this index error is only recorded for subsequent correction, if desired, as their readings as well as the others have all been reduced to the same standard. Simply, therefore, all the thermometric readings have been reduced to one standard which is — ·339 less than the Calcutta.

The Pluviometer used was one supplied from the Arsenal, Calcutta, and consisted, simply of a tube made perfectly cylindrical, in which a float, carrying a divided scale which passed through two guides in the funnel-shaped top, was raised by the rain as it fell. The uppermost of these guides formed the index and corresponded exactly to zero on the scale when the Pluviometer was empty. Four linear inches on the scale corresponding to one inch in the fall of rain, and the scale being originally divided to exhibit tenths of an inch, these divisions were readily subdivided again into four parts, so that $\frac{25}{1000}$ of an inch were indicated by each division, and it was very easy to estimate a smaller quantity if needful.

No Anemometer was used, as I could not obtain any of such a construction as would yield any useful results. In recording the observations of the wind, therefore, I have used the numerical series established by Admiral Beaufort, in which the relative forces of the wind are expressed by numbers from 1 to 12. There is of course, a difficulty in the use of such a scale, arising from the impossibility of always applying it with equal accuracy, and from the different values which different observers would attach to the same numbers. In recording these observations, however, care was taken as far as it was possible, to maintain the same standard of comparison, and the records therefore possesses a relative, if not a readily ascertainable positive value. In the brief observations of the state of the weather and clouds, the simple notation of Beaufort, has been used, and in the column headed "Weather" a record of the several appearances of the sky, and of the state of the weather will be found.

With reference to the position of the instruments, the Thermometer and Barometer were placed in front of a window facing due North (magnetic) in the Bungalow, in which I resided, and were protected on all sides by venetian blinds, (which in no place came nearer to them than 10 inches) from the effect of radiation, and from the direct influence of rain,

&c. The bulb of the Thermometer was nearly at the height above the ground of the centre of the Barometer, the bulb of which has been stated to have been three feet two inches above the ground. The Pluviometer was placed in the centre of a small raised plot in front of the house, at an elevation to the level of the top of the funnel of three feet four inches. It was freely exposed on all sides, there being but few trees or other higher objects in the vicinity, and none within a less distance than 30 feet.

Having thus briefly described the nature and position of the instruments, a very few remarks on the observations themselves will suffice.

Undoubtedly one of the most striking of these results is the enormous quantity of rain which fell. For this I was in some degree prepared by the few results of previous observations which had been published. In a paper by Lieutenant Yule, entitled "Notes on the Khasia Hills and People," published in the *Journal of the Asiatic Society of Bengal*, Vol. XIII. page 612, the author states that in August 1841, during five successive days, 30 inches of rain fell in 24 hours, the total fall for that month being 264 inches; a statement which I confess appeared to me incredible before I visited these hills. And previously to this Mr. Cracroft had given the results of some observations for a few months of the year 1832, from which it appeared that in July of that year there fell 73·724 inches; in August 52·386; in September 55·309, and from 1st to the 8th October 15·790, making a total fall for 16 days of June, the whole of the months of July, August and September, and for eight days of October, or for 116 days, of 225·789 inches, an enormous fall, but trifling as compared with Lieutenant Yule's statement. From my own observations during 1851, the total fall during the months of July, August, September and October, was 292·545 inches. I am fortunately able to add to these results of my own observations, the fall during the preceding months of the year, through the kindness of Dr. Fayrer, Medical Officer then in charge of the station, who carefully recorded the daily fall. From Doctor Fayrer's records, the total fall during the earlier months of the year 1851 was—for

| | |
|---|---|
| January, ... ... ... ... ... ... ... | ·75 |
| February, ... ... ... ... ... ..... | 3·05 |
| March, ... ... .. ... ... ... .. | 1·30 |
| April, ... ... ... ... ... .. ..... | 31·35 |
| May, ... ... .. ... ... ... ... | 114·90 |
| June, ... ... ... ... ... ... ..... | 148·53 |
| Making a total up to June 30th of | 299·88 |

If to this, I add my own observations up to the 13th of November, there results a total fall of 592·425 inches.

I have further been recently informed by Lieutenant H. Raban, Adjutant, Sylhet Light Infantry, that there has not been an inch of rain subsequently to my having left Cherra Poonjee: and in confirmation of this, I may mention that from Doctor Fayrer's observations for December 1850, it appears that no rain fell in that month. It is certain therefore that these results give a very close approximation, if not a perfectly accurate return of the fall of rain during the entire year of 1851, and that this amounted to *five hundred and ninety-two inches or to eight fathoms and a quarter of water*; for it seems absurd to use a smaller unit in treating of such a quantity. Of this enormous quantity the greatest fall which took place during any one day and night or 24 hours, was on the 2nd of July, when 25·485 inches fell between 9 o'clock A. M. on the 1st, and 9 o'clock A. M. on the 2nd. The next largest amount during 24 hours, was on the 15th of September, when 13·190 inches fell between 9 o'clock A. M. on the 15th, and 9 o'clock A. M. on the 16th.

The longest continued fall of rain was during August, when from the 5th to the 15th, there was an uninterrupted fall. From the returns given above, it will be obvious that the whole of this enormous yearly fall is concentrated into a few months; the five months from November to March (inclusive) being almost entirely free from rain. If further we look over the daily records, it will appear that during the other months, there were in April fifteen days on which no rain fell, and four on which the fall was less than an inch; during May, not a single day without rain, and only six on which the fall was, during 24 hours, less than one inch. During June, only five days on which there was no rain and *(of the remaining* 25*)* one on which the fall was less than an inch.

| | | | | | | |
|---|---|---|---|---|---|---|
| During July,..... | 4 | days of no rain, | 11 | of less than 1 inch. | | |
| „ August, ... | 7 | ditto | 7 | ditto | ditto. | |
| „ September, | 12 | ditto | 5 | ditto | ditto. | |
| „ October, ... | 7 | ditto | 10 | ditto | ditto. | |

So that during the seven months from April to October inclusive, being 214 days, there were only 50, or less than one-fourth of the number, on which no rain fell; that of the remaining 164, there were only 47, on which the fall was less than one inch, or on which the rain could be considered slight.

From these statements, it will be obvious that during the hot months of the year, the atmosphere at Cherra Poonjee is continually charged with moisture, and that there is an almost constant deposition of this moisture

Several careful observations indicated an average height for the vapour plane during the wet months of 3,100 to 3,200 feet, while the elevation of the station of Cherra Poonjee is about four thousand feet. I have frequently observed also that during the finer weather a regularly-defined line of clouds was traceable at an elevation of about 100 feet above the station. We have before stated that the station of Cherra is placed but a very small distance from the top of the very sudden rise of the hills along the frontier here. The heated air, therefore, charged with moisture during its passage over the flooded plains of Bengal, and thus saturated to the full amount which its temperature can retain, meeting with the Cossia Hills, becomes rapidly chilled down; the saturated sponge is, as it were, suddenly squeezed, and the moisture which it previously held, is immediately deposited. Nor does the physical conformation of the surface, immediately around Cherra Poonjee itself, exercise an unimportant influence in this respect. A reference to the map will show that the station is placed immediately on the verge of the deep valley of Mawsmai, which with its branches enters far into the range of hills, stretching up for some miles beyond the station to the North, while at a short distance to the West is the other great valley which comes up to the village of Mamloo, and which branching off still further to the West, follows the valley of the Boga-Pani for miles through the hills. Up and into these two great valleys, the surcharged mist which floats over the plains is driven by the prevailing winds (from South and West) and suddenly meeting the precipitous termination of these valleys, its moisture falls on the station of Cherra Poonjee. About three miles North from the village of Cherra, where the road to Assam passes close to the edge of that portion of the great valley of Cherra Poonjee, and where at the same time the smaller and less precipitous valley to the West (along the side of which it had wound its way for some distance) terminates, (thus leaving a narrow table between the two valleys) the influence of these valleys is often well seen. Rolling up from either side, the thick fog-like mist will be seen rising in heavy banks from the lower levels, and meeting in a dense mass above, but rapidly vanishing, as it deposits its heavy charge of moisture; while within the distance of a few hundred yards, the atmosphere will be clear and dry. Again, the distribution of the rain in the hills, and the far greater amount which falls along their verge near to the plains, as compared with the quantity which falls more inland, is well known to the natives; and it is not at all an uncommon occurrence to leave Cherra Poonjee in heavy rain, and after passing northwards, or into the hills for some distance, to find that the limits of the rain have been passed; and that the weather is fine, clear, and dry, while the thick bank of nimbus clouds still hangs over the country to the South During a trip across the hills in October, this was well seen, for while the weather we experienced admitted of being out all day with enjoyment, there was an almost continuous fall of rain during the whole time at Cherra Poonjee. We had a good deal of rain during the nights, when the temperature fell, but during the day very little.

There can be no doubt so far as the question of rain is concerned, (and the excessive dampness is one of the greatest objections to the station,) that some locality more within the hills, and further from the injurious influences to which I have referred, would have been a much more desirable position for the sanitarium. *(a)*

During the month of June, a very heavy flood occurred in the Boga-Pani and other mountain streams, which caused much injury; carried away several bridges, among others the Suspension Bridge over the Boga-Pani; and, near the mouth of the same river flooded and swept away a considerable portion of the large village of Cheyla. This occurred on the 14th of the month, and a reference to the tables will show that on this day, there was by no means so heavy a fall as on some other days during the year. And a visit to the localities, where the greatest damage was done, at once showed that the greater proportion of the mischief resulted, not so much from the actual amount of rain that fell, and the rise of the waters consequent thereon, as from the waters being impeded in their course, and ponded back by numerous great slips of earth and stones, carrying down with them trees and underwood. The torrent, meeting with such obstacles, must have been restrained until its accumulated force burst through every barrier, and swept every thing before it. In parts of the Boga-Pani, the rise was not less than 50 feet, and the richly wooded slopes of that valley were next morning scored with innumerable gullies and deep ravines, extending frequently from the level of the water up to the very summit of the steep banks. From one of these deep cuts, in which a small stream usually found its course, a mass of rubbish consisting of stones of various sizes had been carried down, which I found, on a rough calculation, to contain not less than (5000) five thousand tons of matter. The stones varied in size from 20 cubic feet, to one, or something less, but all the smaller and finer material had been entirely swept away. Not a vestige of the large Suspension Bridge over the Boga-Pani river was left; a single screw bolt, which had formed one of the fastenings of the wall-plates, alone indicated that such a structure had ever existed; and when the waters had subsided, one of the heavy cast-iron standards, which had supported the chains could be seen about 250 yards down the stream, jammed between the huge blocks of stone in the river bed.

In some of the little re-entering angles of the road, where some projecting rock had diverted the force of the stream, and caused an eddy to form, in which the water was comparatively still, sand, *fine* sand was heaped up to a thickness of from five to six feet. A thick range of trees which formed a shady covering to the road for nearly a mile and between

*(a)* This excessive dampness, united with the change of temperature consequent on the increased elevation, affects most persons on their first arrival in the hills, by producing diarrhœa sometimes of an obstinate, although never of violent type. Few persons entirely escape; with many this only occurs once, but with others, even after a temporary visit to the plains, a return to the hills is the sure forerunner of another attack.

it and the river, was entirely and cleanly swept away, and with it the strongly-formed revetment wall which supported the road.

The hour at which the flood or torrent-wave, for such it was, passed and swept away the Suspension Bridge is not known; but it must have been in the morning, as most fortunately, it did not reach Cheyla, until nearly eight o'clock A. M., by which time the inhabitants had all risen. Had it taken place during the darkness of night; many lives must have been lost in the alarm and confusion, but being day-light not a single person I believe was carried off.

To such sudden rises all mountain torrents must be more or less liable, but during previous years, the waters in this stream were never known to rise to much more than half the height they reached on the occasion now referred to, at least, since these hills have passed under British rule.

*Temperature.*—The average temperature at Cherra Poonjee during the summer months, as determined by these observations compared with those made at the Surveyor General's Office in Calcutta, appears to be more than 15 degrees less than in Calcutta. Thus the mean temperature for July at Cherra Poonjee was 69·73, the maximum 73·58, and the minimum 65·87: in Calcutta, the mean temperature for the same month was 84·30; for the other months the temperature was as follows: *(a)*

| | At Cherra Poonjee. | | | At Calcutta. | | | Difference of Mean Temperature. |
|---|---|---|---|---|---|---|---|
| | Mean Maximum. | Mean. | Mean Minimum. | Mean Maximum. | Mean. | Mean Minimum. | |
| July, ... ... ... ... | 73·58 | 69·73 | 65·87 | 89·00 | 84·30 | 79·50 | 14·57 |
| August, ... ... ..... | 74·39 | 70·12 | 65·85 | 89·90 | 85·30 | 80·50 | 15·18 |
| September, ... ... ... | 73·78 | 69·47 | 65·17 | 90·90 | 86·00 | 81·00 | 16·53 |
| October, ... ... ..... | 71·34 | 66·35 | 61·35 | 87·40 | 82·00 | 76·60 | 15·65 |
| November, ... ... ... | 69·04 | 61·52 | 54·00 | 84·00 | 76·20 | 68·10 | 14·68 |

*(a)* The mean monthly temperatures given here are derived from the observations of the maxima and minima Thermometers, as these are the only data common to both localities.

*(b)* By the kindness of Dr. Fayrer, who regularly recorded the temperature during the other months of the year at sunrise; 9*h*. 50*m*.; 12*h*; 14*h*. 40*m*.; 16*h*.; and sunset, or six times during the day, I am enabled to give the mean results his observations for those months not included in my tables. Thus, commencing with December 1850:

We have thus an average depression of temperature at Cherra Poonjee, as compared with Calcutta during the months here referred to, *(b)* of 15·32 degrees, an amount quite sufficient to recommend it strongly, as a place of retreat for Europeans, who may have suffered from exposure to the burning heats of a tropical sun in the plains.

But in the selection of a locality, as a resort for invalids, whose weakened state may render them peculiarly susceptible of sudden changes of temperature, a knowledge of the *range* of the Thermometer within short intervals of time, is almost as requisite as a determination of the actual temperature; and for this the records of the maximum and minimum Thermometers become essential. In the following short table therefore, the results of such observations are briefly given. Thus in July 1851, the maximum temperature of the month being 82·00, the minimum 64·00, the greatest range of the Thermometer for the whole month was 18·00, the greatest daily range however was only 14·75, and the least daily range 4·50, the mean of all the daily ranges being 8·51; similarly, the results of the observations during the other months are given :—

| | Maximum Temperature. | Minimum Temperature. | Maximum range for month. | Maximum range for 24 hours. | Minimum range for 24 hours. | Mean range for 24 hours. | Calcutta. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Maximum daily range. | Minimum daily range. | Mean daily range. | Maximum range for whole month. |
| July, ... ... ... | 82·00 | 63·50 | 18·50 | 15·50 | 3.50 | 7·74 | 13·40 | 2·90 | 9·52 | 17·20 |
| August, ... ..... | 82·00 | 64·00 | 18·00 | 14·75 | 4.50 | 9·62 | 11·90 | 6·90 | 8·40 | 17·80 |
| September, ... ... | 79·00 | 61·00 | 18·00 | 13·50 | 3·00 | 8·25 | 13·00 | 3·60 | 9·90 | 17·10 |
| October, ... ..... | 79·75 | 52·50 | 27·25 | 18·50 | 4·00 | 11·25 | 15·60 | 5·20 | 10·80 | 21·40 |
| November, ... ... | 70·50 | 50·00 | 20·50 | 18.50 | 5·00 | 11·75 | 19·30 | 12·20 | 16·10 | 23·00 |

In December, the highest observed temperature was 62·00 lowest 42·00 mean 52·00
January, ditto ditto ditto 63·00 ditto 43·00 ditto 54·08
February, ditto ditto ditto 64·00 ditto 40·00 ditto 54·94
March, ditto ditto ditto 76·00 ditto 55·00 ditto 66·18
April, ditto ditto ditto 77·00 ditto 58·00 ditto 67·07
May, ditto ditto ditto 77·00 ditto 61·00 ditto 69·42
June, ditto ditto ditto 77·00 ditto 68·00 ditto 71·77

The mean temperatures here given are derived from *all* the observations of the month, there being no maximum and minimum readings; but it must be borne in mind that there were no observations during the night, and that these are therefore only to be taken as the means of the hours between sunrise and sunset.

From this table, it will be evident that the climate of Cherra Poonjee, so far as the temperature, and the changes of temperature, are concerned is not open to any serious objection, that it is cooler than the plains of Calcutta by an average difference of at least 15 degrees, while at the same time the range of the Thermometer during 24 hours does not exceed that experienced on the plains.

*Barometric Pressure.*—The mean pressure of the atmosphere reduced to 32° Faht., during the period to which our observations refer, was 25·742, being for the month of July 25·670 inches; for August 25·668, for September 25·703, for October 25·815, and for November (up to the 13th) 25·853. From these results, the gradual and regular increase in the amount of pressure, as we approach the winter half year, is evident; while at the same time the detailed observations show the regularity with which the two daily tides occurred. This is also well seen in the accompanying tabular projections of the Barometric readings. For the entire period to which our observations relate, the average range of the Barometer between 3 o'clock A. M. and 9 o'clock A. M., was ·060, and between 3 o'clock P. M. and 9 o'clock P. M., was ·053.

A reference to the hourly observations on the 21st of each month, however, shows that these hours are not those at which the maximum and minimum pressures occur, but that the maxima (or high tides) are more nearly at or about 9*h.* 30*m.* A. M. and 10*h.* 30*m.* P. M., and the minima at about 4*h.* 30*m.* A. M. and 4*h.* 30*m.* P. M.

*Hygrometry.*—The remarkably damp condition of the atmosphere at Cherra Poonjee, made it desirable to ascertain with some care the effect of the moisture contained in the atmosphere in influencing the Barometric column, and in the tables annexed the Hygrometric depression, and the force of the aqueous vapour (calculated by Apjohn's formula $F = f - \frac{d}{88} \frac{h}{30}$ are carefully recorded.

During the months referred to, there were not many remarkable atmospheric phenomena observed at Cherra Poonjee. The thunder storms which occurred were not of any great violence. Frequently such storms were seen passing over the plains of Sylhet to the South, apparently violent and bad: and on these occasions the lightning forked with the most vivid brightness; but the usual mode of occurrence of lightning in the hills was in broadly spread flashes, occasionally lasting for many seconds, and lighting up the heavens, and all around with a quiet brightness more like the calmness of sunset than the fearful flash of a lightning storm. Occasionally these flashes were of the most vivid and intense violet colour, occasionally of deep and lurid red. On the night of the 3rd of August, the former colour was very remarkably shown. On one occasion, (October 26th,) the heavens were remark-

ably lighted up by vivid flashes of lightning, which succeeded each other with great rapidity, and which appeared to proceed from two centres which remained almost constantly illuminated, and were like great balls or rather hemispheres of light. These were in the North, and the light of the flashes illumined fully one-half of the quadrant between the horizon in that direction and the zenith.

On two or three evenings, a halo was observed round the moon, but on none of these occasions were there any very remarkable appearances or any curious phenomena connected therewith.

Some earthquake shocks were felt during the summer of 1851 : of these the sharpest was during the morning of the 9th of October. I was at the time at *Nungklow* on the Assam side of the Khasi Hills, and at that village it occurred exactly at five minutes before 3 A. M. The direction of the motion was very distinctly from the S. E. and the wave which was quite sufficient to throw one gently over in bed, was accompanied by a rumbling noise, not very loud, but continuous during about 35 seconds. The direction of the motion was distinctly traceable, not only from the motion felt in bed, but from the direction in which some light things were thrown, which lay on a shelf in the room. Among others was a Daniell's Hygrometer which was upset by the wave.

The same shock was felt at Cherra Poonjee, as nearly as I could ascertain, from a comparison of watches, and from careful enquiries on my return, at 8½ minutes before 3. I regret that this record of the times of occurrence at these distant localities is not sufficiently accurate to enable any trustworthy inference to be drawn regarding the rate of translation of the wave-motion across the hills; but as far as they go, the difference of time observed would correspond to a rate of translation of about nine miles per minute ; *Nungklow* being in a right line about 32 miles from Cherra Poonjee. The principal shock was preceded by a slight and scarcely perceptible one about half an hour before.

On the afternoon of the 15th of the same month, *viz.*, October, two slight shocks were experienced at Cherra Poonjee, one at twelve minutes past three o'clock in the afternoon, and a second at 35 minutes past three ; the motion was distinctly from the South and East in both cases. The day had been rainy with a light wind from the South-West and the night succeeding was one of almost incessant thunder and lightning. On the evening of the 4th of July another slight shock was felt passing Cherra Poonjee at 48 minutes past 8 o'clock in the evening. The direction of the motion which was only slight was not very distinct, but appeared to be from the South and West.

It is not intended here to enter upon any enquiry into the remarkable effects of the peculiar conditions of climate which we have described as exhibited in the varieties of vegetation, the presence or absence of peculiar forms, and further in the remarkable physical outline of the country and the peculiar contour which it presents, depending upon the erosive power of the enormous quantity of rain which falls, combined with the Geological structure. Nor shall we point out the peculiar modification which this outline undergoes in different portions of the hills. These are questions belonging rather to the Physical Geography of the district, and will not therefore be discussed here.

Before concluding these remarks, it may be desirable to notice the extremely local distribution of much of the rain even within such limited distances as a few hundred yards. A striking instance of this occurred to myself on the 12th of October. About 4 o'clock in the afternoon of that day, I was geologizing at about ½ of a mile from the place where my rain gauge was placed; mist and driving cloud passed over me with a few drops of rain and continued for about 40 minutes, but scarcely sufficient to wet the light clothes I wore, and not at all such as to compel me to return home; on my return I was greatly surprised to find that during the same time *more than half an inch* of rain was indicated by the gagne: At first, I doubted the accuracy of this, I fancied that some accident or design had led to this result, but on the most ample and strict enquiry, I found it was not so; and that the rain, not more than 500 yards from where I had experienced only a driving mist, had come down in torrents.

I believe that these local differences, will, to a very great extent, account for some minor differences, which were observable in comparing Dr. Fayrer's returns and my own. As a whole Dr. Fayrer's returns were in excess of mine, a difference arising partly from my reading smaller quantities than Dr. Fayrer did, and partly I am convinced from a really greater fall. It is perfectly known to the residents at the station that some of the houses are more constantly affected by the mist and cloud from the valleys than others, and especially those which are near to the deep valley to the East of the station, and Dr. Fayrer's gauge was nearer to this valley than mine; about half-way. Thus the return of the rain for September from Dr. Fayrer's table was 70·80 inches while we had only 66·640. In July Dr. Fayrer's return gave 100·35: ours gave only 96·280.

These differences however, though sufficiently marked to command attention, do not at all affect the accuracy of the return viewed on the large scale, *as indicating an amount of rain fall unequalled by any as yet recorded in any other part of the globe.*

The year 1851, to which these observations refer was, it must be borne in mind, remarkable for the excessively small quantity of rain which fell in Bengal; the amount in Calcutta

being considerably less than the average quantity. It is impossible in the absence of detailed observations to say how far this was the case at Cherra Poonjee, but it was not considered by the natives to be an unusually wet year.

*Dated, May 22nd,* 1852.

To the foregoing observations, made during my visit in 1851, I am now enabled to add a few results obtained during the succeeding year. In 1852, my sojourn at Cherra was of much shorter duration. I did not arrive until July, and left early in October. My frequent absence from the station, and the want of any person to whom I could entrust the observations prevented me from procuring anything like a regular series of daily observations. I was however able to procure the observations hourly on the term days of July, August and September; and these are tabulated in the accompanying returns. The same instruments having been used in these observations, no further description of them is necessary. I did not occupy the same bungalow, and they were therefore somewhat differently placed. They were carefully protected as before from effects of radiation, &c., and placed with a northerly aspect in an open verandah. Their position was also a few feet higher than in 1851.

I have already observed that the season of 1852, was drier and finer than that of 1851. It was indeed considered by the residents at Cherra Poonjee a remarkably fine season. Up to the period of my leaving the station in the beginning of October 1852, the amount of rain which fell is given in the following table, and for comparison I have repeated the fall for 1851 :—

| | January. | February. | March. | April. | May. | June. | July. | August. | September. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1852, ..... | 0·000 | 1·450 | 9·900 | 28·600 | 49·750 | 83·250 | 168·520 | 58·450 | 49·710 | 449·630 |
| 1851, ..... | 0·750 | 3·050 | 1·300 | 31·350 | 114·900 | 148·530 | 96·280 | 88·540 | 66·460 | 551·160 |

From this it appears, that during the three months of my visit, *(a)* there fell 276·680 inches of rain: and up to the close of September 449·63 inches, as compared with 551·160 inches in the year 1851. With this great difference in the total fall, there was a larger fall in one month in 1852, *viz.*, July, than in any month for 1851, being 168·520 in July 1852: as compared with 148·530 in June 1851. The heaviest fall on the other hand, during

*(a)* I am indebted to the kindness of Dr. Fletcher for the returns of the months prior to my arrival. For July, August and September, the numbers given are from my own observations.

any 24 hours in 1852 was 16·95 (on the 19th of July) as compared with 25.485 on the 2nd of July 1851.

Rejecting the consideration of the months previous to April, which may be considered as *rainless* months, and comparing the other months, as I have done for 1851, with regard to the number of days without rain, we find that

| | | | | | | |
|---|---|---|---|---|---|---|
| In April | 1852, there were | 17 | days on which no rain fell, | 6 | days on which the fall was less than one inch. |
| May | „ „ | 12 | „ | 6 | „ |
| June | „ „ | 5 | „ | 7 | „ |
| July | „ „ | 3 | „ | 3 | „ |
| August | „ „ | 6 | „ | 12 | „ |
| September | „ „ | 12 | „ | 10 | „ |
| making a total of | | 55 | „ | 44 | „ |
| as compared with | | 43 | and | 37 | similar days in 1851, |

during the corresponding months.

During May and June, the rain fell chiefly by night, so that the actual number of dry *days* was greater than that given above.

With regard to temperature, the following are the results for the year 1852, for comparison with those given above for 1851 :—

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| In January, | the highest observed temperature was | 62·00 | lowest | 50·00 | mean | 56·00 |
| February, | „ | „ | „ | 70·00 | „ | 51·00 | „ | 60·50 |
| March, | „ | „ | „ | 70·00 | „ | 51·00 | „ | 60·50 |
| April, | „ | „ | „ | 74·00 | „ | 54·00 | „ | 64·00 |
| May, | „ | „ | „ | 80·00 | „ | 60·00 | „ | 70·00 |
| June, | „ | „ | „ | 74·00 | „ | 63·00 | „ | 68·50 |
| July, | „ | „ | „ | 73·00 | „ | 62·00 | „ | 67·50 |
| August, | „ | „ | „ | 80·00 | „ | 63·00 | „ | 71·50 |
| September, | „ | „ | „ | 81·00 | „ | 62·00 | „ | 71·50 |

The mean temperature was therefore a little, but only a little, higher in 1852, than in 1851.

The mean Barometric pressure was also higher in 1852 than in 1851.

These results, although in themselves of but little value, fully confirm the observations for 1851.

Having passed the corresponding months of the present year (1853) at Darjeeling, another hill station, I may offer a few remarks on the comparative climates of the two places founded on personal observation, and on information communicated by others, which may be useful. Darjeeling, as is generally known, is situated on one of the lower and outlying ridges of the great Himalaya range, at an elevation, varying in different parts of the station, from 6,500 to 7,400, the mean height of the greater portion of the station being about 7,000 feet. It is at a considerable distance from the plains within the hills, (in a direct line about 16 miles,) and it is partially protected on the south by the higher ridge of Senchal and its spurs. It is freely open on the north to the Snowy range, of which it commands a perfectly unrivalled view, which extends for many miles east and west of the great culminating points of Kunchinjinga, the highest known summit on the earth's surface. (28·177 feet.) All round the station, the hills form a succession of remarkably steep and sharp saddle-backed ridges, with deep glens, (from 3,000 to 5,000 feet below the station,) and are covered with an almost uninterrupted and dense mass of foliage and wood, with thick underwood and jungle. It is in Latitude 27° 3′ 0″ North and Longitude 88° 18′ 40″ East.

Comparing these two Stations as regards rain, &c., it appears that the mean annual fall at Darjeeling is scarcely more than ¼ of the mean annual quantity at Cherra Poonjee. Taking the years referred to above, namely 1851 and 1852, the comparative falls were, as below.*(a)*

| | 1851. | 1852. | |
|---|---|---|---|
| Cherra Poonjee,... | 592·525 | 449·63 | to October 1st. |
| Darjeeling, ..... | 126·500 | 104·70 | |

If further, we compare the number of *dry* days at each station, (rejecting as before the months from November to April which are nearly rainless) the comparative result is shown in the following table :—

| | Days of no rain. | Days of less than 1·000 inch. | TOTAL. | |
|---|---|---|---|---|
| Cherra Poonjee, 1851, | 50 | 47 | 97 | |
| „ 1852, | 55 | 44 | 99* | * This was only to 30th September. |
| Darjeeling, 1851, | 102 | 61 | 163 | |
| „ 1852, | 96 | 85 | 181 | |

(a) For the Darjeeling Returns I am indebted to Dr. Withecombe, whose great care in recording these observations renders them peculiarly trustworthy.

From this it appears, that while there is nearly four times the quantity of rain falling at Cherra, the distribution of this is not in the same proportion at all: for the number of fine days is not twice as many at Darjeeling, as at Cherra. Besides, where the fall is so excessive, a day with less than 1·000 inch of rain is a *fine* day, while at Darjeeling a fall in 24 hours of one inch generally produces a wet day. The greatest monthly fall during the two years referred to, was in July 1852, when there were 35·40 inches recorded, or an average fall *in the* 24 *hours* of 1·15 inch, at Darjeeling.

But a fair estimate of the climatal condition of any locality can scarcely be formed from a consideration of the fall of rain; more especially as regards the comfort or convenience of residents. It is obvious, that for most purposes of enjoyment, a fall of rain of only five inches spread over the whole time is much more objectionable than a fall of 15 inches, confined to 15 hours out of the 24; while the state of the atmosphere, amount of cloud, fog, wind, &c., are all equally important considerations. The mean humidity of the atmosphere is a much safer guide in estimating the conditions of any locality as to moisture, than the actual fall of rain. I have no means of comparing this at the two stations for the same year, but taking my own results for four of the wettest months in 1851, and the corresponding result for the same months in 1853 at Darjeeling, (comparison in favor of Darjeeling, as the latter year was finer than 1851,) we find as follows:—

| | July. | August. | September. | October. | Mean of 4 months. |
|---|---|---|---|---|---|
| Cherra Poonjee, 1851, | ·873 | ·960 | ·932 | ·916 | ·920 |
| Darjeeling, ..... 1853, | ·917 | ·936 | ·928 | ·887 | ·917 |

We have here, the very unexpected result, that the mean humidity of the wettest season of the year, is within a small fraction (·003) the same at these two stations, although the actual fall of rain is four times greater at one place than at the other.

There is at Darjeeling a very remarkable absence of wind. During the whole of the present season I only find, on examining my daily records a single entry in which the force of the wind, stated according to Beaufort's scale, amounted to 4·; the large majority (4 out of 5) days giving nothing more than 0—1, or being nearly quite calm. I confess myself quite unable to explain the cause of this absence of wind, but it is an universally admitted fact. The consequence however, of this stagnation of the atmosphere, is the almost constant presence of cloud and fog, which rise from the deep glens around, and hang

for days unmoved over the station.(a) This gives a peculiarly heavy, oppressive and gloomy feeling, and one which, judging from personal experience, is extremely unpleasant.

Consequent on this, and partly due also to the greater elevation, and local position of the station, there is greatly less *certainty* in the weather, than at Cherra Poonjee. Even when apparently most settled, it cannot be depended on for an hour, while, in the Khasi Hills, even during the height of the rains, there frequently occur breaks of the most lovely summer weather, continuing for several days.

As regards the mean temperature of these two stations, it would naturally be anticipated, both from the much greater elevation of the place, and from its more northerly latitude, combined with its greater distance from the plains that there should be a very marked difference, or depression, at Darjeeling as compared with Cherra Poonjee. This anticipation, however, is not altogether supported by the result of observation. I give in a Tabular form the results obtained at both places during the same year (1851), from which it will appear that while there is during the winter months a very much lower temperature at Darjeeling than at Cherra Poonjee, the difference is not by any means so marked during the summer months.(b)

| 1851. | January. | February. | March. | April. | May. | June. | July. | August. | September. | October. | November. | December. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cherra Poonjee, ..... | 53·70 | 55·10 | 65·30 | 67·10 | 69·30 | 71·30 | 71·80 | 72·40 | 72·40 | 68·20 | ..... | ..... |
| Darjeeling, ..... ..... | 40·90 | 41·70 | 51·80 | 55·30 | 61·90 | 62·50 | 63·70 | 64·30 | 63·20 | 55·80 | 50·40 | 44·80 |
| Difference, ..... | 12·80 | 13·40 | 13·50 | 11·80 | 7·40 | 8·80 | 8·10 | 8·10 | 9·20 | 12·40 | ..... | ..... |

It will be seen also, that the difference between the extreme mean temperatures for the whole year is much greater at Darjeeling than at Cherra, being at the former place 23·40, at the latter only 18·70, or in other words, the temperature at the latter station is more equable throughout the year than at Darjeeling.(c)

(a) The loftier position and more open aspect of the Jilla-pahar, the convalescent depôt of Her Majesty's Troops is placed, render it much less liable to this covering of cl hile the fall of rain is considerably more than in the civil station below.

(b) These results are taken from the Returns of temperature, rain, &c. many stations in Bengal, &c. published, *Journal Asiatic Society*, 1852, No. 7.

(c) In a valuable paper by Dr. Grant, Bengal Medical Service, published in the *Indian Annals of Medical Science*, No. 1, page 311, in noticing some of the Himalayan Sanitaria, the author gives some tables showing the mean temperature of each month at these stations, which are sufficiently curious and interesting to be repeated here.

I do not pretend to offer any opinion on the choice of such places, as a summer resort for invalids, or a temporary residence for persons who may be suffering from the intense heat of the plains of India, and from the diseases which so commonly affect Europeans there. But I would express my own personal feelings, (the feelings of one in good health and not long in a tropical clime,) that notwithstanding the enormous fall of rain, the climate of Cherra Poonjee is greatly to be preferred to that of Darjeeling. It is much more bracing and less gloomy and depressing. The sensation there is that of an English summer (a wet summer certainly); the sensation at Darjeeling is that of a foggy English November.

I am aware that Cherra Poonjee once established as a sanitarium for troops has been abandoned as such. I do not know the causes which led to this; but from personal inspection I feel satisfied that bad accommodation in houses not water-tight and almost below the level of the ground, coupled with the facility of obtaining at an extremely low price the native spirits, was a tenfold more frightful cause of illness, or of non-recovery, than any defect of climate.

The results of all my observations are given in detail in the accompanying Tabular forms, and from these each can draw his own deductions. I should be sorry to be under-

| | January. | February. | March. | April. | May | June. | July. | August. | September. | October. | November. | December. | Height. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kussowlie, ... | 42·0 | 47·4 | 58·5 | 64·4 | 77·2 | 73·9 | 70·5 | 70·6 | 72·1 | 66·2 | ..... | ..... | 6400 |
| Subathoo,..... | ..... | ..... | ..... | 77·00 | 81·5 | 84·5 | 79·3 | 77·00 | ..... | ..... | ..... | ..... | 4000 |
| Dugshai, ..... | 42·00 | 47·0 | 57 | 64·00 | 69·00 | 71·0 | 72·0 | 68·00 | 66·0 | 62·00 | 54·0 | 53.0 | 6000 |
| Simla, ..... | 40·00 | 44·1 | 53·4 | 61·3 | 66·3 | 80·9 | 75·5 | 78·1 | 70·00 | 67·9 | 52·3 | 46·1 | 8000 |
| Nainee Tal,... | 42·1 | 46·5 | 56·00 | 61·2 | 69·5 | 69·6 | 67·8 | 69·2 | 65·1 | 61·5 | 50·1 | 47·9 | 6200 |
| Landour, ..... | 35·9 | 40·7 | 51·3 | ..... | ..... | ..... | ..... | ..... | 68·0 | 64·1 | 49·6 | 46·3 | 7300 |
| Murree, ..... | ..... | ..... | ..... | ..... | ..... | 69·5 | 68·4 | 66·7 | 62·1 | 62·8 | ..... | ..... | 6786 |

Comparing these results with those given above for the two hill stations of Bengal, some curiously anomalous facts come out. Thus the mean temperature at Simla with somewhat greater elevation, and 5 degrees more northerly latitude is during the summer months considerably higher than at Darjeeling. It is also higher than at Kussowlie or Dugshai, which are nearly in the same latitude, but the elevation of which is some 2,000 feet less. It is again considerably higher than the summer temperature at Nainee Tal, which is also 2,000 lower, and nearly 2 degrees more southerly. Compared with Cherra Poonjee, the latitude of which is 6 degrees more southerly, and the elevation 4,000 feet less—the difference of the mean temperature of the 7 months from April to October inclusive, is actually 1 degree in excess or higher at Simla than at Cherra.

I have above given Dr. Grant's returns, they being fuller than the tables from which a large proportion of them is copied, published in *Asiatic Journal*, 1852, No. 5, p. 384. I do not suppose that returns for a single year are at all sufficient to draw just conclusions from, but the general result, though differing in degree, must be in the same direction. There are a few striking differences between the numbers given by Dr. Grant, and those in the *Asiatic Journal*.

stood as intending to convey more than my own sensations in speaking of the *comparative* advantages of the two localities. Darjeeling possesses many, very many recommendations, both climatal and otherwise; and for many reasons its lower temperature, (differing on the average of the year by about 10 degrees from that of Cherra Poonjee) ought to give it a preference. On the other hand, although the station in the Khasi Hills is on one of the barest spots which could well have been selected, yet in the midst of the most lovely scenery, still the facility of passing into the interior, and the ease with which the hills can be traversed in almost any direction, offers a strong inducement to those who may not like to be confined within the narrow bounds of a station.

I have above mentioned the smaller amount of rain, which falls within the hills, *(a)* as compared with Cherra Poonjee; and having just alluded to the position of the station, I may here quote my own words, when originally submitting these Meteorological observations for 1851. I then said "that the same advantages of climate, which Cherra Poonjee offers, "could be more effectively secured at other localities, within the Khasi hills, further from "the influence of the plains. And these localities would at the same time offer greater "facility of access to the daily increasing number of European residents in Assam."

"Placed geographically between the great plains of Assam, and of Sylhet, and acces-"sible with ease from either side, the Khasi hills would seem to have been indicated by "their position, as the place for a convenient hill-resort, common to the inhabitants of both; "although at present the station is placed on the extreme Southern verge of the district."—*(May, 1852.)*

The danger at present attending the passage of the "terai" on the Assam side would soon vanish with the progress of improvement, as has been the case elsewhere.

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*(a)* A similar fact has been established near Darjeeling. Thus at Kursion, facing the plains, and the elevation of which is about the same as that of Cherra Poonjee, the fall of rain during the months from May to October (1853), was 146·07 inches, as compared with 114·21, during the same time at Darjeeling.—*(Dr. Withecombe's returns.)*

## *Observations made at Cherra*

3 o'CLOCK A. M.

| Humdity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Of Mercury. | Of Air. | Of Dew-point. | | | | | | | |
| ·949 | | 1 | 25·665 | 68·00 | 67·50 | 66·75 | ... | ·693 | 2· S W, | ..... | ..... | R. M. | ..... |
| 1·000 | | 2 | ·729 | 67·50 | 67·00 | 67·50 | ... | ·711 | 3· S W, | ..... | ..... | O. R. | Continuous heavy rain, thunder during night. |
| 1·000 | | 3 | ·713 | 67·50 | 66·50 | 66·50 | ... | ·688 | 3· S W, | ..... | ..... | R. | ..... |
| 1·000 | | 4 | ·668 | 66·50 | 66·00 | 65·75 | ... | ·672 | 3· S W, | ..... | ..... | R. M. | Rain, but not heavy. |
| 1·000 | | 5 | ·659 | 67·00 | 67·00 | 66·50 | ... | ·688 | 1· W S W, | ..... | ..... | R. O. M. | Heavy thick rain, very dark night. |
| 1·000 | ☽ | 6 | ·724 | 67·50 | 67·00 | 67·50 | ... | ·711 | 2·3 S W, | ..... | Ks. N. | O. D. R. | Raining slightly. |
| 1·000 | | 7 | ·715 | 68·00 | 67·50 | 68·50 | ... | ·734 | 1· S W, | ..... | ..... | O. D. M. | Occasional flashes of lightning. |
| 1·000 | | 8 | ·65b | 67·00 | 66·50 | 67·00 | ... | ·699 | 1· W S W, | ..... | ..... | O. M. | ..... |
| ·950 | | 9 | ·613 | 69·00 | 68·50 | 67·50 | ... | ·711 | 0·1 E by S, | ..... | K. | R. | Few detached clouds. |
| 1·000 | | 10 | ·732 | 67·50 | 67·50 | 67·50 | ... | ·711 | 1·0 S W, | ..... | ..... | O. R. M. | Rain and driving mist. |
| ·949 | | 11 | ·721 | 68·00 | 67·50 | 66·50 | ... | ·688 | 1· S W, | ..... | ..... | O. R. | Heavy rain commenced a little after 2 o'clock. |
| 1·000 | | 12 | ·697 | 67·00 | 66·75 | 67·00 | .. | ·699 | 3· W S W, | ..... | ..... | O. R. | Rain nearly continuous. |
| ·949 | ⊙ | 13 | ·595 | 68·00 | 67·75 | 66·50 | ... | ·688 | 1· S W, | ..... | ..... | O. R. | Heavy misty rain. |
| ·898 | | 14 | ·616 | 65·50 | 65·00 | 62·50 | ... | ·604 | 1· W by N, | ..... | Ks. | R. | Bright moonlight but clouded. |
| ·000 | | 15 | ·595 | 69·00 | 68·75 | 69·00 | ... | ·745 | ..... | ..... | Ks. | R. | Occasionally overcast. |
| ·949 | | 16 | ·593 | 70·00 | 67·50 | 67·00 | ... | ·699 | ..... | ..... | ..... | O. M. | Occasional flashes of lightning. |
| ·953 | | 17 | ·624 | 70·00 | 69·50 | 68·50 | ... | ·734 | ..... | ... .. | R. Cs. | O. P. L. | Cloudy, heavy rain between 12 and 3. |
| ·907 | | 18 | ·617 | 72·50 | 71·25 | 69·00 | ... | ·745 | ..... | ..... | K. S. | L. | Occasional lightning. |
| ·865 | | 19 | ·638 | 72·50 | 71·50 | 68·50 | ... | ·734 | 1·2 W S W, | ..... | ... | R. L. | Clear moonlight lightning occasionally all night. |
| 1·000 | | 20 | ·773 | 67·50 | 67·00 | 67·00 | ... | ·699 | 1· S W, | ..... | ..... | R. M. | ..... |
| 1·000 | | 21 | ·730 | 67·00 | 66·75 | 67·00 | ... | ·699 | 2· S W, | ..... | ..... | O. R. M. | Continued rain. |
| 1·000 | | 22 | ·625 | 67·50 | 67·00 | 66·50 wet bulb | ... | ·688 | 1· W by S, | ..... | ..... | R. O. | Heavy and continuous rain from 10 P. M. |
| ·949 | | 23 | ·581 | 68·00 | 67·50 | 67·25 | ·25 | ·656 | 5·4 S E, | ..... | ..... | R. M. | Fresh breeze and continuous rain. |
| 1·000 | | 24 | ..... | ..... | ..... | ..... | ... | ... | ..... | ..... | ..... | ..... | ..... |
| ·949 | | 25 | ·640 | 66·00 | 65·75 | 65·25 | ·50 | ·611 | 4· S by W, | ..... | ..... | R. M. O. | ..... |
| ·949 | | 26 | ·668 | 67·00 | 66·50 | 66·25 | ·25 | ·634 | 0· S W, | ..... | ..... | M. O. | ..... |
| ·949 | | 27 | ·678 | 67·00 | 66·75 | 65·75 | 1·00 | ·617 | 0·1 E by S, | ..... | Ks. C. | ..... | Clouded. |
| ·949 | | 28 | ·677 | 68·50 | 67·50 | 66·25 | 1·25 | ·625 | 1· W by S, | ..... | K. Cs. | ..... | Dark and cloudy. |
| ·950 | | 29 | ·681 | 70·00 | 69·00 | 68·25 | ·75 | ·674 | ..... | ..... | K. | O. | Do. do. l. and showers in early part of night. |
| ·907 | | 30 | ·649 | 71·50 | 70·00 | 67·00 | 3·00 | ·625 | 0·1 E by N, | ..... | ..... | R. V. | Fine starlight. |
| 1·000 | | 31 | ·614 | 71·00 | 70·00 | 70·00 | ·00 | ·723 | 1·0 N E, | ..... | S. Cs. | R. | Clear above, a few clouds on horizon. |
| ·967 | Means, ... | | 25·661 | 68·30 | 67·67 | 67·07 | ·87 | ·687 | | | | | |

N. B. From the 1st to the 22nd of July, the Dew-point Hygrometer was used.

## *Poonjee, during July* 1851.

9 O'CLOCK A. M.

| Barometer reduced to 32° Faht. | Temperature Of Mercury. | Temperature Of Air. | Temperature Of Dew-point. | D. | F. | Temperature. Maximum. | Temperature. Minimum. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·736 | 70·50 | 69·75 | 69·50 | ... | ·757 | 73·00 | 67·00 | 2· S W, | 7·220 | ..... | R. | Continuous rain. | 1 | | 1·000 |
| ·770 | 70·00 | 69·50 | 69·00 | ... | ·745 | 73·00 | 67·00 | 4· W S W, | 25·485 | ..... | R. | Very heavy rain. | 2 | | 1·000 |
| ·748 | 70·50 | 69·75 | 69·00 | ... | ·745 | 71·00 | 65·00 | 2· S S W, | 13·795 | ..... | M. O. | Thick cloudy fog mist. | 3 | | 1·000 |
| ·676 | 69·00 | 68·25 | 67·50 | ... | ·711 | 70·00 | 65·00 | 2· W S W, | 5·545 | ..... | M. | Foggy mist. | 4 | | 1·000 |
| ·709 | 69·50 | 68·50 | 70·50 | ... | ·782 | 74·50 | 67·00 | 1· E S E, | ·300 | ..... | O. D. M. | Thick small rain. | 5 | | 1·000 |
| ·786 | 71·00 | 69·75 | 70·25 | ... | ·776 | 74·50 | 65·50 | 2· W S W. | 1·025 | ..... | O. D. M. | Thick mist. | 6 | | 1·000 |
| ·747 | 70·50 | 69·75 | 69·50 | ... | ·757 | 73·00 | 66·00 | 1·0 S W, | ·275 | ..... | O. D. M. | | 7 | | 1·000 |
| ·681 | 70·50 | 69·75 | 69·75 | ... | ·763 | 72·50 | 66·50 | 0·1 W S W, | 1·575 | ... .. | O. | Heavy rain. | 8 | | 1·000 |
| ·719 | 73·00 | 72·25 | 69·50 | ... | ·757 | 71·00 | 66·50 | 2· E S E, | ·120 | K. N. | B. O. | Blue sky above overcast all round. | 9 | | ·953 |
| ·776 | 69·50 | 69·00 | 68·50 | ... | ·734 | 73·00 | 65·50 | 1· W S W, | 2·575 | ..... | O. D. M. | | 10 | | 1·000 |
| ·733 | 68·00 | 67·25 | 66·50 | ... | ·688 | 72·00 | 65·00 | 2· W S W, | 4·370 | ..... | O. R. | | 11 | | 1·000 |
| ·666 | 69·00 | 68·75 | 68·50 | ... | ·688 | 69·50 | 65·50 | 2· W S W. | 1·665 | ..... | O.M. D.R. | | 12 | | 1·000 |
| ·665 | 67·50 | 67·25 | 67.50 | ... | ·711 | 72·00 | 65·00 | 1·2 S W, | 3·250 | ..... | O. R. | | 13 | | 1·000 |
| ·661 | 72·50 | 71·75 | 69·00 | ... | ·745 | 73·50 | 63·50 | 1·0 W S W, | ·630 | KS. | B. M. | Drifting mist. | 14 | | ·907 |
| ·641 | 71·50 | 70·75 | 69·00 | ... | ·745 | 74·00 | 65·00 | ..... | ·000 | KS. | O. | Cloudy with slight mist. | 15 | | ·907 |
| ·657 | 73·00 | 72·00 | 70·00 | ... | ·770 | 74·00 | 65·50 | 1· E by S, | ·220 | K. C. | B. M. | Sunshine with passing cloud. | 16 | | ·953 |
| ·637 | 76·00 | 74·50 | 72·00 | ... | ·822 | 76·00 | 68·00 | 2· N E, | ·600 | ..... | B. | Fine and clear. | 17 | | ·968 |
| ·632 | 77·00 | 76·25 | 71·50 | ... | ·808 | 78·00 | 66·50 | 1·2 S E, | ·000 | K. | B. | Do. | 18 | | ·865 |
| ·689 | 76·50 | 75·50 | 71·50 | ... | ·808 | 82·00 | 66·50 | 1·2 E by S, | ·095 | K. C. | B. | Do. | 19 | | ·865 |
| ·831 | 69·50 | 68·75 | 69·00 | ... | ·745 | 73·00 | 65·50 | 1·0 S W, | 1·440 | O. | R. M. | Heavy mist and cloud. | 20 | | 1·000 |
| ·743 | 67·25 | 66·75 | 67·00 | ... | ·699 | 71·00 | 66·50 | 4· S W, | 8·090 | ..... | O. R. | | 21 | | 1·000 |
| ·653 | 68·00 | 67·50 | wet bulb | ... | ... | 69·00 | 66·50 | 2· E S E, | 9·971 | ..... | M. R. O. | Misty thick rain. | 22 | | 1·000 |
| ·617 | 68·00 | 67·75 | 67·50 | ·25 | ·662 | 72·50 | 65·00 | 3· S E, | 3.370 | ..... | R. M. D. | | 23 | | 1·000 |
| ·681 | 68·00 | 67·50 | 66·25 | 1·25 | ·625 | 71·50 | 63·50 | 0·1 S by W, | 1·870 | K. | B. O. | | 24 | | ·899 |
| ·673 | 68·00 | 67·25 | 66·75 | ·50 | ·643 | 73·50 | 64·50 | ..... | 1·920 | ..... | R. M. O. | Drizzling rain. | 25 | | 1·000 |
| ·721 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 71·00 | 65·00 | 0·1 N E, | ·750 | ..... | O. M. | | 26 | | ·949 |
| ·738 | 73·00 | 72·25 | 70·75 | 1·50 | ·726 | 75·00 | 65·50 | 0·1 S E, | ·045 | K. CS. | B. | Very fine. | 27 | | ·953 |
| ·748 | 72·00 | 71·75 | 70·25 | 1·50 | ·714 | 76·00 | 66·00 | 1· N E, | ·025 | KC. CS. | B. | Do. | 28 | | ·907 |
| ·732 | 76·00 | 74·75 | 72·75 | 2·00 | ·772 | 74·00 | 67·50 | ..... | ·000 | K. | O. | | 29 | | ·908 |
| ·707 | 78·50 | 77·25 | 75·75 | 1·50 | ·860 | 76·00 | 67·00 | 1· E by N, | ·054 | ..... | R. V. | Cloudless. | 30 | | ·953 |
| ·648 | 76·00 | 75·00 | 74·75 | ·25 | ·844 | 82·00 | 68·00 | 1·2 N E, | ·000 | K. S. | B. | | 31 | | 1·000 |
| 25·704 | 71·23 | 70·48 | 69·55 | 1·05 | ·742 | | | | 96·280 | | | | | | ·965 |

From the 22nd to the end of the month, the "wet bulb."

## *Observations made at Cherra*

3 O'CLOCK P. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Dew-point. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1·000 | | 1 | 25·703 | 73·50 | 72·75 | 72·75 | ... | ·840 | 3· S W by S, | ..... | ..... | R. | Continuous rain. |
| ·976 | | 2 | ·713 | 71·00 | 70·50 | 70·00 | ... | ·770 | 4· W S W, | ..... | ..... | R. | Very heavy rain. |
| 1·000 | | 3 | ·688 | 70·00 | 68·75 | 68·50 | ... | ·733 | 4· S W, | ..... | ..... | R. | ..... |
| ·963 | | 4 | ·615 | 74·50 | 74·00 | 72·75 | ... | ·840 | 1· S S W, | ..... | ..... | M. | ..... |
| ·865 | | 5 | ·660 | 75·00 | 74·50 | 69·50 | ... | ·757 | 1·0 S W, | ..... | K. S. | O. R. | ..... |
| ·953 | ☽ | 6 | ·714 | 73·00 | 72·00 | 70·50 | ... | ·783 | 1· W S W, | ..... | ..... | O. D. M. | Drizzling mist. |
| ·953 | | 7 | ·645 | 73·50 | 72·50 | 71·50 | ... | ·809 | 1· S W, | ..... | ..... | O. M. D. | ..... |
| 1·000 | | 8 | ·613 | 71·00 | 69·50 | 69·00 | ... | ·745 | 1· S E, | ..... | ..... | O. D. M. | Detached clouds. |
| ·907 | | 9 | ·680 | 73·00 | 71·50 | 69·00 | ... | ·745 | 1· E N E, | ..... | KS. | O. R. | Partly overcast. |
| ·907 | | 10 | ·714 | 72·50 | 71·25 | 69·00 | ... | ·745 | ..... | ..... | KS. S. | ..... | ..... |
| 1·000 | | 11 | ·646 | 69·00 | 68·50 | 68·50 | ... | ·733 | 1·2 W S W, | ..... | K. | O. M. | Misty, clear to E. with K. clouds. |
| ·953 | | 12 | ·594 | 71·50 | 70·50 | 69·50 | ... | ·757 | 2· S W, | ..... | K. N. | O. R. P. | ..... |
| ·908 | ⊙ | 13 | ·571 | 74·00 | 73·25 | 69·50 | ... | ·757 | 1· W S W, | ..... | K. S. | R. | Clear with a few drifting clouds. |
| ·953 | | 14 | ·528 | 74·50 | 73·00 | 71·00 | ... | ·796 | 2· N E, | ..... | ..... | R. | Do. Do. |
| ·908 | | 15 | ·630 | 74·00 | 73·00 | 70·00 | ... | ·770 | 2· S E, | ..... | ..... | C. M. | Cloudy and misty. |
| ·951 | | 16 | ·628 | 76·00 | 74·00 | 73·00 | ... | ·849 | 1· S E, | ..... | KS. CS. | O.D. C.R. | Drifting clouds. |
| ·867 | | 17 | ·621 | 78·00 | 76·50 | 73·00 | ... | ·849 | 2· N E, | ..... | ..... | R. | Bright sunshine. |
| ·787 | | 18 | ·525 | 83·00 | 81·00 | 73·00 | ... | ·849 | 1·2 S E, | ..... | K. | R. O. | Do. Do. |
| ·953 | | 19 | ·690 | 72·50 | 72·25 | 70·00 | ... | ·770 | 2· S W, | ..... | ..... | O. R. | Wind changed from E. by S. to S. W. at 3 o'clock heavy rain, distant thunder. |
| ·953 | | 20 | ·750 | 70·50 | 69·75 | 69·00 | ... | ·745 | 2· S W, | ..... | ..... | O. D. M. | Drifting cloud and fog. |
| 1·000 | | 21 | ·650 | 69·00 | 68·25 | 68·00 wet bulb | ... | ·722 | 2· S W, | ..... | ..... | M. R. O. | ..... |
| 1·000 | | 22 | ·572 | 72·50 | 71·50 | 70·50 | 1·00 | ·726 | 2· S by W, | ..... | ..... | O. R. M. | A few patches of blue sky to North. |
| 1·000 | | 23 | ·560 | 72·00 | 71·00 | 70·25 | ·75 | ·721 | 2· S by E, | ..... | ..... | O. R. | Continuous rain and mist. |
| 1·000 | | 24 | ·603 | 74·50 | 72·50 | ..... | ... | ... | 2· S by W, | ..... | ..... | R. V. | Clear and transparent. |
| 1·000 | | 25 | ·648 | 72·00 | 71·00 | ..... | ... | ... | 1· S by W, | ..... | CS. | D. C. O. | Few clouds. |
| ·953 | | 26 | ·671 | 76·00 | 73·00 | 71·25 | 1·75 | ·737 | 1· E by N, | ..... | ..... | R. D. | Clear sunshine. |
| ·908 | | 27 | ·655 | 76·50 | 75·25 | 72·75 | 2·50 | ·768 | 0·1 S by E, | ..... | K. | O.R. K.S. | Partially overcast. |
| 1·000 | | 28 | ·630 | 74·25 | 73·25 | 73·25 | ·00 | ·806 | 1· W by N, | ..... | C. K. | R. | A few passing clouds. |
| ·907 | | 29 | ·630 | 76·00 | 74·00 | 72·25 | 1·75 | ·762 | ..... | ..... | KS. | O. D. | ..... |
| ·910 | | 30 | ·618 | 82·00 | 81·00 | 79·25 | ·75 | ·973 | 1· E by N, | ..... | KS. | R. V. | Very clear. |
| ·926 | | 31 | ·536 | 79·75 | 78·50 | 77·50 | 1·00 | ·917 | 2· E by S, | ..... | KS. | R. T. | Thunder rolling to N. W. Thermom. in sun 108·00. |
| ·985 | Means, ... | | 25·636 | 74·02 | 72·52 | 71·17 | 1·19 | ·785 | | | | | |

N. B. From the 1st to the 22nd the Dew-point Hygrometer was used.

## *Poonjee, during July* 1851.

9 O'CLOCK P. M.

| Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Dew-point. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·766 | 70·00 | 69·75 | 68·50 | ... | ·733 | ..... | ..... | C. CS. | R. | Rain less heavy. | 1 | ·953 |
| ·764 | 69·00 | 68·75 | 69·00 | ... | ·745 | 3· S W, | ..... | ..... | R. | Rain, but lighter. | 2 | 1·000 |
| ·726 | 69·75 | 69·00 | 69·00 | ... | ·745 | 3· S W, | ..... | ..... | R. M. | Continuous rain. | 3 | 1·000 |
| ·652 | 72·75 | 72·50 | 71·75 | ... | ·809 | 1· S W, | ..... | ..... | M. | ..... | 4 | ·953 |
| ·746 | 70·00 | 69·75 | 69·00 | ... | ·745 | 1· W S W, | ..... | K. | O. | Dry and light night. | 5 | 1·000 |
| ·721 | 68·50 | 68·00 | 69·50 | ... | ·757 | 1· S W, | ..... | K. S. N. | B. | A few stars visible but cloudy. | 6 | 1·000 |
| ·662 | 69·00 | 68·50 | 69·00 | ... | ·745 | 2· S W, | ..... | ..... | O. M. | Occasional mist. | 7 | 1·000 |
| ·656 | 70·00 | 69·50 | 69·00 | ... | ·745 | 1· E by S, | ..... | KS. | B. | Bright moonlight. | 8 | ·953 |
| ·766 | 69·00 | 69·50 | 69·50 | ... | ·757 | 1·0 S W, | ..... | ..... | O. R. | Rain and drizzling mist. | 9 | 1·000 |
| ·770 | 68·00 | 68·50 | 67·50 | ... | ·710 | ..... | ..... | C. K. | B. | Clear moonlight. | 10 | ·953 |
| ·677 | 68·00 | 67·50 | 67·50 | ... | ·710 | 2·3 W S W, | ..... | ..... | O. D. M. | Occasional rain but thickly overcast. | 11 | 1·000 |
| ·630 | 69·00 | 69·50 | 69·50 | ... | ·757 | 1·0 W S W, | ..... | C. S. | B. | Clear light night. | 12 | 1·000 |
| ·618 | 69·00 | 68·00 | 66·50 | ... | ·688 | 1· S W, | ..... | CS. KS. | B. | Halo round moon of 53° 20′ diamt. very light in W. with K. C. radiating from N. & S. points. | 13 | ·949 |
| ·638 | 71·50 | 70·75 | 69·00 | ... | ·745 | 0· W S W, | ..... | S. N. | O. | Looks threatening. | 14 | ·953 |
| ·637 | 70·00 | 69·50 | 69·50 | ... | ·757 | ..... ..... | ..... | S. | O. | Slight lightning about 10 P. M. | 15 | 1·000 |
| ·647 | 72·00 | 71·00 | 71·00 | ... | ·796 | 2· N E, | ..... | ..... | O. L. | Much flash l. in S. E. from 7½ to 8 o'clock. | 16 | 1·000 |
| ·598 | 73·00 | 72·50 | 69·00 | ... | ·745 | 1· S E, | ..... | K. S. | B. L. | Much lightning in E. and N. for some hours. | 17 | ·864 |
| ·615 | 74·50 | 74·00 | 72·50 | ... | ·835 | 2· E by S, | ..... | K. S. | O. M. | Heavy rain about 8½ o'clock. | 18 | ·951 |
| ·778 | 69·00 | 68·75 | 68·75 | ... | ·738 | 1· S W, | ..... | ..... | M. D. R. | Raining. | 19 | 1·000 |
| ·778 | 69·00 | 68·25 | 68·00 | ... | ·722 | 2· S W, | ..... | ..... | O. M. R. | Continued rain and cloud. | 20 | 1·000 |
| ·671 | 67·00 | 66·50 | 66·00 | ... | ·678 | 1· W S W, | ..... | ..... | M. R. O. | Very dark, wind gone down. | 21 | ·949 |
| ·597 | 70·00 | 69·00 | 69·00 wet bulb | ... | ·745 | 4· S W, | ..... | ..... | O. R. M. | Very dark and wet. | 22 | 1·000 |
| ·621 | 68·00 | 66·50 | 66·50 | ·00 | ·648 | 2·5 S by E, | ..... | ..... | O. R. | Thick dirty weather, wind freshening. | 23 | 1·000 |
| ·694 | 67·50 | 67·00 | 67·00 | ·00 | ·654 | 1·2 S by W, | ..... | ..... | R. M. O. | ..... | 24 | 1·000 |
| ·689 | 68·00 | 68·00 | ..... | ... | ... | 1· W, | ..... | ..... | O. G. U. | Very dark and cloudy. | 25 | 1·000 |
| ·691 | 70·00 | 69·00 | 67·25 | 1·75 | ·642 | 1· N E, | ..... | ..... | B. V. | Bright starlight. | 26 | ·902 |
| ·707 | 70·00 | 69·50 | 68·50 | 1·00 | ·678 | 0·1 S by E, | ..... | K. S. | B. | Partially overcast. | 27 | ·953 |
| ·686 | 71·50 | 70·75 | 70·25 | ·50 | ·724 | 1· S E, | ..... | S. CS. | P. B. M. | Flashes of lightning in E., rain began at 7 o'clock. | 28 | ·953 |
| ·702 | 71·00 | 70·25 | 68·25 | 2·00 | ·662 | ..... | ..... | KS. | B. | ..... | 29 | ·907 |
| ·634 | 74·00 | 73·50 | 72·00 | 1·50 | ·758 | 1·0 E by N, | ..... | S. | B. V. L. | Clear starlight with constant lightning, a few S. on horizon. | 30 | ·907 |
| ·578 | 73·00 | 73·00 | 72 25 | ·75 | ·771 | ..... | ..... | ..... | B. T. L. | Clear starlight with distant t. and l. | 31 | ·953 |
| 25·681 | 70·03 | 69·50 | 69·00 | ·731 | | | | | | | | ·979 |

From the 22nd to the end of the month the "wet-bulb."

## *Observations taken at Cherra*

3 O'CLOCK A. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1·000 | | 1 | 25·583 | 70·00 | 69·25 | 69·25 | ·00 | ·705 | 1·2 S W, | ..... | ..... | O. R. | Heavy rain. |
| 1·000 | | 2 | ·558 | 73·00 | 70·75 | 70·75 | ·00 | ·741 | 0·1 S W, | ..... | S. | R. | Clear, with a few clouds about horizon. |
| ·953 | | 3 | ·610 | 71·00 | 70·75 | 69·25 | 1·50 | ·690 | 3·4 S W, | ..... | ..... | O. L. T. | Squally, lightning vivid, deep violet in colour. |
| ·953 | | 4 | ·623 | 70·50 | 69·50 | 69·25 | ·25 | ·702 | 1· S W, | ..... | ..... | O. R. | Rain, but not heavy. |
| 1·000 | | 5 | ·651 | 70·00 | 69·50 | 69·50 | ·00 | ·711 | 2· S W, | ..... | ..... | O. R. L. | Very heavy rain, occasional flashes of lightning. |
| 1·000 | | 6 | ·613 | 69·50 | 68·25 | 68·25 | ·00 | ·682 | 5·2 S W, | ..... | ..... | O. R. | Heavy rain, squally. |
| 1·000 | | 7 | ·639 | 68·00 | 67·50 | 67·50 | ·00 | ·665 | 3·4 S W, | ..... | ..... | O. R. D. | Good breeze. |
| 1·000 | | 8 | ·623 | 68·50 | 68·00 | 68·00 | ·00 | ·676 | 7·8 S W, | ..... | ..... | R. | Blowing freshly with heavy rain; 6 o'clock wind S. E. |
| ·949 | | 9 | ·595 | 68·00 | 67·50 | 67·25 | ·25 | ·656 | 10 S W, | ..... | ..... | O. R. M. | Stiff gale all night. |
| 1·000 | | 10 | ·595 | 68·50 | 67·50 | 67·50 | ·00 | ·665 | 7·8 W W S W, | ..... | ..... | R. | Heavy rain. |
| ·950 | | 11 | ·647 | 69·00 | 68·50 | 68·25 | ·25 | ·670 | 5·4 S W, | ..... | ..... | R. M. | Foggy and misty. |
| 1·000 | ⊙ | 12 | ·625 | 69·00 | 68·50 | 68·50 | ·00 | ·687 | 2·7 S W, | ..... | ..... | R. | Very squally. |
| 1·000 | | 13 | ·580 | 68·00 | 67·50 | 67·50 | ·00 | ·665 | 7·9 S W, | ..... | ..... | R. | Squally with stiff breeze. |
| 1·000 | | 14 | ·569 | 68·50 | 68·00 | 68·00 | ·00 | ·676 | 5· W S W, | ..... | ..... | R. L. | Heavy rain, lightning. |
| 1·000 | | 15 | ·652 | 68·00 | 67·25 | 66·50 | ·75 | ·635 | 0·1 S W, | ..... | K. C. S. | R. | Almost calm. |
| ·947 | | 16 | ·694 | 69·00 | 68·50 | 67·25 | 1·25 | ·647 | 0·1 S by E, | ..... | K. CK. S. | O. C. | Calm but clouded. |
| 1·000 | | 17 | ·730 | 68·50 | 68·00 | 67·50 | ·50 | ·660 | 2· S W, | ..... | ..... | R. | Very heavy rain. |
| 1·000 | | 18 | ·722 | 68·00 | 67·50 | 67·50 | ·00 | ·665 | 7·5 W S W, | ..... | ..... | O. M. R. | Raining heavily with stiff breeze. |
| 1·000 | | 19 | ·668 | 68·25 | 67·50 | 67·50 | ·00 | 665 | 3·4 W by S, | ..... | ..... | R. | Heavy rain. |
| 1·000 | | 20 | ·681 | 67·75 | 67·00 | 67·00 | ·00 | ·654 | 2· W S W, | ..... | ..... | R. M. | Continuous rain. |
| ·949 | | 21 | ·668 | 67·00 | 66·50 | 66·00 | ·50 | ·627 | 5·6 S S W, | ..... | ..... | O. M. | ..... |
| 1·000 | | 22 | ·721 | 67·50 | 66·50 | 65·75 | ·75 | ·618 | 2·3 W S W, | ..... | N. K. | O. M. | Drizzling mist. |
| ·949 | | 23 | ·723 | 66·50 | 66·00 | 65·25 | ·75 | ·608 | 2· W by S, | ..... | S. | R. | Clear night. |
| ·949 | | 24 | ·717 | 68·00 | 67·75 | 67·00 | ·75 | ·646 | 2· W by S, | ..... | N. C. | M. | Cloudy, slight rain. |
| ·949 | | 25 | ·702 | 68·00 | 67·25 | 66·25 | 1·00 | ·628 | 1· S S W, | ..... | K. CS. | C. | Dark and cloudy. |
| ·949 | | 26 | ·730 | 68·00 | 68·00 | 66·50 | 1·50 | ·628 | 0·1 S by E, | ..... | CS. K. | R. L. | Clear with clouds on horizon, lightning in South all night. |
| 1·000 | | 27 | ·666 | 70·00 | 69·25 | 68·75 | ·50 | ·688 | 1·0 S by E, | ..... | K. CS. | O. R. | Partially overcast. |
| ·950 | | 28 | ·651 | 69·00 | 68·75 | 67·75 | 1·00 | ·661 | 2· S by W, | ..... | ..... | R. | ..... |
| ·953 | | 29 | ·685 | 71·00 | 70·00 | 69·25 | ·75 | ·697 | 1· E by S, | ..... | ..... | R. | Clear, bright star light night. |
| ·953 | | 30 | ·665 | 71·50 | 70·75 | 70·25 | ·50 | ·724 | ..... | ..... | C. CS. K. | R. L. | Occasional lightning. |
| ·949 | | 31 | ·658 | 67·50 | 66·75 | 66·25 | ·50 | ·632 | 5· S by W, | ..... | ..... | R. M. | Misty rain. |
| ·977 | Means, ... | | 25·653 | 68·87 | 68·20 | 67·77 | ·43 | ·667 | | | | | |

*Poonjee, during August* 1851.

9 O'CLOCK A. M.

| Barometer reduced to 32° Fahr. | Temperature of Mercury. | Temperature of Air. | Temperature of Wet-bulb. | D. | F. | Temperature. Maximum. | Temperature. Minimum. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29·591 | 75·00 | 74·25 | 73·75 | ·50 | ·814 | 79·75 | 65·00 | 1·0 S W, | ·140 | K. S. | B. | Thin drifting clouds. | 1 | | 1·000 |
| ·609 | 76·50 | 75·00 | 74·25 | ·75 | ·825 | 80·00 | 68·00 | 0·1 S E N E, | ·020 | K. C. | B. P. | Wind changeable. | 2 | | ·953 |
| ·650 | 76·00 | 76·00 | 74·00 | 2·00 | ·806 | 76·75 | 67·00 | 2·3 S E, | ·675 | C. CS. | B. | ..... | 3 | | ·907 |
| ·603 | 73·50 | 72·50 | 71·50 | 1·00 | ·751 | 77·75 | 68·00 | 1· S S E, | ·145 | K. CS. | B. | Clouds drifting. | 4 | | 9·53 |
| ·600 | 70·00 | 69·25 | 68·75 | ·50 | ·688 | 80·00 | 67·50 | 1·2 S W, | 2·245 | ..... | O. R. | ..... | 5 | | 1·000 |
| ·604 | 70·00 | 69·50 | 68·75 | ·75 | ·685 | 75·50 | 66·50 | 1· S W, 6 o'clock 3 S E, | 4·340 | ..... | O. M. D. | Misty rain. | 6 | | ·953 |
| ·604 | 70·50 | 69·50 | 68·75 | ·75 | ·685 | 72·00 | 66·00 | 3· W by S, | 6·910 | ..... | R. | Wind changeable. | 7 | | ·953 |
| ·608 | 69·50 | 68·50 | 68·00 | ·50 | ·671 | 72·50 | 66·00 | 6· S E, | 7·250 | ... .. | R. | Continued rain. | 8 | | ·950 |
| ·651 | 69·50 | 68·50 | 67·50 | 1·00 | ·656 | 71·00 | 65·00 | 7· W S W, | 8·775 | ..... | R. O. | ..... | 9 | | ·950 |
| ·657 | 70·00 | 69·25 | 69·00 | ·25 | ·696 | 70·50 | 66·00 | 6· S by E, | 9·570 | ..... | O. R | Continuous rain. | 10 | | 1·000 |
| ·692 | 70·50 | 69·75 | 69·00 | ·75 | ·691 | 71·50 | 67·00 | 4· S W, | 4·850 | ..... | R. M. D. | ..... | 11 | | ·953 |
| ·696 | 70·00 | 69·50 | 69·25 | ·25 | ·702 | 72·50 | 66·50 | 6·7 W S W, | 3·925 | ..... | R. | Wind squally and fresh. | 12 | | ·953 |
| ·617 | 69·50 | 69·00 | 69·00 | ·00 | ·699 | 70·50 | 66·00 | 7·9 S by W, | 6·445 | ..... | R. | Distant thunder from 6 to 9 A. M. | 13 | | 1·000 |
| ·645 | 68·00 | 67·50 | 66·25 | 1·25 | ·625 | 71·50 | 65·00 | 3· W by S, | 7·380 | ..... | R. O. | Very heavy rain. | 14 | | ·899 |
| ·703 | 67·75 | 66·75 | 65·50 | 1·25 | ·609 | 73·00 | 65·00 | 2·1 N N E, | 4·975 | ..... | R. | Rain from 5 A. M. | 15 | | ·949 |
| ·744 | 70·25 | 69·75 | 69·25 | ·50 | ·700 | 70·50 | 65·25 | 0·1 S by E, | ·600 | S. CS. | O. M. D. | Rain from 5 A. M. | 16 | | ·949 |
| ·703 | 70·00 | 69·25 | 69·00 | ·25 | ·696 | 75·00 | 66·00 | 5· S S W, | 1·770 | C. | O. R. | Thick drizzling rain. | 17 | | 1·000 |
| ·748 | 68·50 | 68·00 | 67·75 | ·25 | ·667 | 72·50 | 65·00 | 7·9 W S W, | 3·350 | ..... | R. | Heavy rain with stiff breeze. | 18 | | 1·000 |
| ·729 | 67·25 | 67·50 | 67·00 | ·50 | ·649 | 70·00 | 65·00 | 3·4 W, | 8·240 | ..... | R. | ..... | 19 | | ·949 |
| ·740 | 69·50 | 68·75 | 68·25 | ·50 | ·677 | 70·00 | 64·50 | 3· S S W, | 1·550 | ..... | R. M. | Continuous rain. | 20 | | ·950 |
| ·764 | 68·75 | 68·00 | 67·50 | ·50 | ·660 | 72·00 | 65·00 | 7· S S W, | 2·610 | ..... | R. | ..... | 21 | | 1·000 |
| ·776 | 70·00 | 69·00 | 67·50 | 1·50 | ·650 | 70·00 | 65·00 | 2· S W, | ..... | ..... | M. D. | ..... ..... | 22 | | ·950 |
| ·779 | 73·00 | 72·50 | 71·25 | 1·25 | ·742 | 75·50 | 64·00 | 2· N by W, | ..... | C. K. | B. | ..... | 23 | | ·908 |
| ·779 | 71·00 | 70·25 | 69·25 | 1·00 | ·690 | 76·00 | 64·50 | 1· S by W, | ·125 | K. N. | ..... | ..... | 24 | | ·953 |
| ·709 | 73·00 | 74·00 | 70·25 | 3·75 | ·602 | 72·00 | 65·00 | 1· S S W, | ..... | K. S. | B. | ..... | 25 | | ·823 |
| ·749 | 73·00 | 71·50 | 69·25 | 2·25 | ·683 | 77·00 | 65·00 | 2· N E, | ..... | C. S. | B. | ..... | 26 | | ·865 |
| ·697 | 72·00 | 71·00 | 69·75 | 1·25 | ·705 | 75·50 | 65·00 | 1· S by W, | ..... | K.C. CS. | O. F. | Partly overcast and foggy. | 27 | | ·953 |
| ·701 | 71·00 | 70·00 | 69·25 | ·75 | ·697 | 75·75 | 66·00 | 1· N, | ·775 | K. | B. C. | ..... | 28 | | ·953 |
| ·740 | 76·25 | 75·25 | 74·75 | ·50 | ·842 | 78·50 | 67·00 | 1·2 E by S, | ..... | C. CS. | B. V. | Very clear air. | 29 | | 1·000 |
| ·727 | 72·00 | 71·25 | 70·75 | ·50 | ·736 | 82·00 | 68·00 | 1·2 E by S, | ..... | K. N. | B. P. | Thunder from 7 to 8 A. M. | 30 | | 1·000 |
| ·704 | 70·00 | 69·25 | 68·00 | 1·25 | ·664 | 70·00 | 66·50 | 5· S S W, | 1·875 | ..... | O. R. M. | Heavy rain and fresh breeze. | 31 | | ·950 |
| 25·704 | 71·02 | 70·32 | 69·42 | ·90 | ·702 | | | | 88·540 | | | | | | ·954 |

## *Observations during*

### 3 O'CLOCK P. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Of Mercury. | Of Air. | Of Wet-bulb. | | | | | | | |
| 1·000 | | 1 | 25·554 | 79·75 | 73·00 | 72·75 | ·25 | ·787 | 2· S E, | ..... | C. K. | F. | Foggy and clouded. |
| 1·000 | | 2 | ·549 | 76·75 | 75·25 | 75·25 | ·00 | ·861 | 1· E, | ..... | C. | B. | ..... |
| ·909 | | 3 | ·571 | 77·50 | 77·00 | 74·50 | 2·50 | ·816 | 2· S E, | ..... | C. CS. K. | B. | Partially clouded. |
| ·953 | ☽ | 4 | ·608 | 79·75 | 77·00 | 76·00 | 1·00 | ·873 | 2· W by S, | ..... | K. S. | B. | Drifting clouds. |
| ·953 | | 5 | ·621 | 75·00 | 73·25 | 71·75 | 1·50 | ·751 | 1· S by W, | ..... | C. S. CS. | B. | Ditto ditto. |
| ·953 | | 6 | ·594 | 72·00 | 71·00 | 69·75 | 1·25 | ·705 | 1· S by E, | ..... | ..... | O. R. D. | Rain, but light. |
| ·953 | | 7 | ·618 | 72·00 | 71·00 | 70·25 | ·75 | ·721 | 2·3 S W, | ..... | ..... | R. | ..... |
| ·953 | | 8 | ·583 | 70·75 | 69·75 | 69·25 | ·50 | ·700 | 7· S by W, | ..... | ..... | R. | Continuous rain. |
| 1·000 | | 9 | ·593 | 70·00 | 69·00 | 69·00 | ·00 | ·699 | 4·5 W S W, | ..... | ..... | O. R. F. | Foggy and thick. |
| ·953 | | 10 | ·604 | 71·25 | 70·50 | 69·75 | ·75 | ·709 | 5· S S W, | ..... | ..... | R. | Ditto ditto. |
| ·953 | | 11 | ·636 | 72·00 | 71·00 | 70·25 | ·75 | ·721 | 2· W S W, | ..... | ..... | M. D. | Mist and drifting rain. |
| 1·000 | ⊙ | 12 | ·607 | 70·00 | 69·00 | 68·75 | ·25 | ·690 | 6· W S W, | ..... | ..... | R. | ..... |
| ·953 | | 13 | ·543 | 71·00 | 69·75 | 69·25 | ·50 | ·700 | 5·6 S by W, | ..... | C. CK. | B. | Drifting clouds. |
| ·907 | | 14 | ·586 | 73·00 | 71·50 | 70·25 | 1·25 | ·717 | 2· E by S, | ..... | ..... | R. M. D. | Drifting rain and mist, wind changeable. |
| ·865 | | 15 | ·641 | 76·00 | 74·50 | 72·25 | 2·25 | ·757 | 2· W by S, | ..... | ..... | B. | Clear sunshine. |
| ·907 | | 16 | ·694 | 75·00 | 73·50 | 72·25 | 1·25 | ·767 | 0·1 S by E, | ..... | C. K. | B. D. | ..... |
| ·953 | | 17 | ·709 | 72·50 | 71·25 | 69·75 | 1·50 | ·702 | 4· W S W, | ..... | K. CS. | B. M. | Slight mist. |
| ·950 | | 18 | ·676 | 69·75 | 68·50 | 68·25 | ·25 | ·679 | 4· S by W, | ..... | K. CS. | B. O. | Partially clouded. |
| ·902 | | 19 | ·611 | 69·00 | 69·00 | 67·25 | 1·75 | ·642 | 3· W, | ..... | ..... | M. D. | Wind N. by E. at 5 P. M. |
| ·907 | | 20 | ·659 | 72·00 | 71·00 | 69·25 | 1·75 | ·688 | 1· E, | ..... | ..... | R. M. D. | Continuous rain. |
| ·950 | | 21 | ·702 | 69·75 | 68·75 | 68·00 | ·75 | ·668 | 6· W by S, | ..... | ..... | R. | Do., fresh breeze. |
| ·907 | | 22 | ·698 | 75·00 | 73·50 | 72·00 | 1·50 | ·758 | 2· W, | ..... | ..... | B. | Clear sunshine. |
| ·865 | | 23 | ·680 | 75·75 | 74·50 | 72·25 | 2·25 | ·757 | 3· W S W, | ..... | C. CS. | B. | Ditto ditto. |
| ·907 | | 24 | ·693 | 72·00 | 71·50 | 70·25 | 1·25 | ·717 | 1· S by W, | ..... | K. CS. | O. M. | Overcast and misty. |
| ·824 | | 25 | ·680 | 76·75 | 75·00 | 71·25 | 3·75 | ·717 | 1· S W, | ..... | CS. K. | B. | Few clouds. |
| ·951 | | 26 | ·645 | 75·00 | 74·00 | 73·00 | 1·00 | ·790 | 3· E by S, | ..... | K. CS. | B. | ..... |
| ·951 | | 27 | ·597 | 75·00 | 74·00 | 72·75 | 1·25 | ·780 | 1· E, | ..... | ..... | O. | Overcast. |
| ·909 | | 28 | ·618 | 78·00 | 77·00 | 75·25 | 1·75 | ·844 | 1· S by W, | ..... | K. S. | B. | Clear and bright. |
| ·909 | | 29 | ·627 | 81·00 | 79·50 | 78·25 | 1·25 | ·938 | 1· N, | ..... | ..... | B. | Ditto ditto. |
| ·953 | | 30 | ·634 | 78·00 | 77·00 | 76·00 | 1·00 | ·873 | 2· W, | ..... | C. CS. | B. | Ditto ditto. |
| ·953 | | 31 | ·632 | 71·00 | 70·25 | 68·50 | 1·75 | ·670 | 4· S by W, | ..... | ..... | R. | Heavy rain. |
| ·935 | | Means, ... | 25·628 | 73·94 | 72·60 | 71·40 | 1·21 | ·748 | | | | | |

*August.—(Continued.)*

9 O'CLOCK P. M.

| Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | Humidity, complete saturation being 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·576 | 72·00 | 71·75 | 71·75 | ·00 | ·766 | 0.1 S W, | ..... | S. | B. L. | Clear, a few clouds on horizon, lightning. | 1 | 1·000 |
| ·614 | 73·00 | 72·25 | 72·25 | ·00 | ·779 | 0·1 S E, | ..... | K. S. | B. L. O. | Lightning very vivid from 6½ P. M. to 8, less so after. | 2 | 1·000 |
| ·634 | 72·50 | 71·50 | 71·25 | ·25 | ·751 | 1· S W, | ..... | K. | O. R. | Much thunder and lightning from 8 to 9, then rain. | 3 | ·953 |
| ·679 | 71·00 | 70·50 | 70·75 | ·25 | ·741 | 2· W by S, | ..... | K. N. | O. M. | Heavy and overcast. | 4 | 1·000 |
| ·666 | 69·50 | 69·00 | 69·25 | ·25 | ·705 | 2·3 W S W, | ..... | ..... | O. R. | Heavy rain from 6 o'clock. | 5 | 1·000 |
| ·670 | 69·75 | 69·00 | 68·50 | ·50 | ·682 | 2·3 S W, | ..... | ..... | R. | Continuous rain. | 6 | 1·000 |
| ·668 | 69·00 | 68·50 | 68·25 | ·25 | ·679 | 6· S W, | ..... | ..... | R. M. | Squally with fresh breeze and heavy rain. | 7 | ·950 |
| ·658 | 67·00 | 66·75 | 66·75 | ·00 | ·647 | 7·0 S W. W S W. | ..... | ..... | R. | Blowing very freshly | 8 | 1·000 |
| ·655 | 69·25 | 68·75 | 68·50 | ·25 | ·684 | 5· W by S, | ..... | ..... | R. | Heavy rain. | 9 | 1·000 |
| ·674 | 69·75 | 69·00 | 68·25 | ·75 | ·674 | 4·5 W S W, | ..... | ..... | R. F. | Do. with fog. | 10 | ·950 |
| ·682 | 69·50 | 68·75 | 68·50 | ·25 | ·684 | 3·4 W S W. S W. | ..... | ..... | R. | Continuous rain. | 11 | 1·000 |
| ·635 | 69·25 | 68·50 | 68·50 | ·00 | ·686 | 6·9 S W, | ..... | ..... | R. | Squally. | 12 | 1·000 |
| ·591 | 69·00 | 68·00 | 68·00 | ·00 | ·676 | 7· W by S, | ..... | K. N. | L. | A few flashes of lightning. | 13 | 1·000 |
| ·655 | 69·25 | 68·25 | 67·75 | ·50 | ·665 | 0·1 S W, | ..... | CS. CK. | B. | ..... | 14 | 1·000 |
| ·693 | 71·00 | 69·50 | 68·75 | ·75 | ·685 | 0·1 W by S, | ..... | S. CS. | O. | Looks threatening. | 15 | ·953 |
| ·764 | 69·00 | 69·00 | 68·50 | ·50 | ·682 | 0·1 S S E. S S W. | ..... | CS. S. | O. | Wind light but very changeable. | 16 | 1·000 |
| ·752 | 69·00 | 67·75 | 67·50 | ·25 | ·662 | 5· W by S, | ..... | C. S. | B. O. | Partially overcast. | 17 | 1·000 |
| ·724 | 68·75 | 68·25 | 67·50 | ·75 | ·657 | 5·10 W S W, | ..... | ..... | R. | Stiff breeze with very heavy squalls and rain. | 18 | 1·000 |
| ·708 | 68·00 | 67·50 | 67·00 | ·50 | ·649 | 2· W by N, | ..... | ..... | R. M. | ..... | 19 | ·949 |
| ·728 | 68·00 | 67·50 | 67·25 | ·25 | ·656 | 2· W S W, | ..... | ..... | M. D. | Dark and cloudy. | 20 | ·949 |
| ·745 | 67·50 | 67·25 | 66·75 | ·50 | ·643 | 2· W by S, | ..... | .... .... | O. | All overcast and dark. | 21 | 1·000 |
| ·770 | 68·00 | 66·50 | 65·75 | ·75 | ·618 | 3· W, | .. ... | ..... | O. O. | Gloomy and dark night. | 22 | ·949 |
| ·702 | 69·00 | 69·50 | 68·75 | ·75 | ·685 | 2· W by S, | ..... | C. CS. | B. L. | Occasional lightning, looks threatening. | 23 | ·949 |
| ·788 | 69·00 | 68·00 | 66·75 | 1·25 | ·636 | 1· S S W, | ..... | CS. K. | B. | Partially clear. | 24 | ·949 |
| ·786 | 69·50 | 69·75 | 69·50 | ·25 | ·708 | 0·1 S by E, | ..... | CS. K. | B. L. | L. in South, clouds on horizon. | 25 | 1·000 |
| ·698 | 70·50 | 69·75 | 69·00 | ·75 | ·691 | 1· S by E, | ..... | K. C. | B. L. | L. in N. and E., ditto. | 26 | ·953 |
| ·667 | 71·00 | 70·50 | 69·25 | 1·25 | ·693 | 1· S by E, | ..... | K. C. S. | B. | Clear above, clouds on horizon. | 27 | ·907 |
| ·671 | 71·00 | 70·00 | 70·00 | ·00 | ·729 | 1· S S by W, | ..... | ..... | B. | ..... | 28 | 1·000 |
| ·677 | 73·50 | 73·50 | 72·50 | 1·00 | ·777 | 1· E N E, | ..... | C. S. | B. L. | Lightning in South from 7 o'clock. | 29 | ·951 |
| ·695 | 72·00 | 71·75 | 70·50 | 1·25 | ·723 | 2· E by S, | ..... | K. N. | R. L. | Rain commenced 8½ o'clock. | 30 | ·953 |
| ·674 | 69·00 | 68·50 | 67·50 | 1·00 | ·656 | 7·9 S S W, | ..... | ..... | O. R. | Blowing very freshly. | 31 | ·950 |
| 25·689 | 69·79 | 69·19 | 68·75 | 0·48 | ·689 | | | | | | | ·976 |

## *Observations taken at Cherra*

3 O'CLOCK A. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Fahr. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Of Mercury. | Of Air. | Of Wet-bulb. | | | | | | | |
| ·949 | | 1 | 25·637 | 68·00 | 67·50 | 67·00 | ·50 | ·649 | 11· S S W, | ..... | ..... | R. | Stiff gale with heavy rain. |
| ·949 | ☽ | 2 | ·648 | 68·00 | 67·75 | 67·25 | ·50 | ·654 | 7·9 S W, | ..... | ..... | R. | Continued rain, blowing freshly. |
| 1·000 | | 3 | ·652 | 69·00 | 68·25 | 67·75 | ·50 | ·665 | 8· W S W, | ..... | ..... | O. R. | Rain almost continuous all night, blowing freshly. |
| 1·000 | | 4 | ·615 | 69·00 | 68·00 | 68·00 | ·00 | ·676 | 8· S W, | ..... | ..... | R. U. | Heavy rain, ditto. |
| ·950 | | 5 | ·643 | 69·50 | 68·75 | 68·00 | ·75 | ·669 | ..... | ..... | ..... | O. F. M. | Dark, foggy, cloudy. |
| ·953 | | 6 | ·692 | 70·50 | 69·50 | 69·25 | ·25 | ·703 | 1·2 S W, | ..... | ..... | O. R. | Heavy rain from 1 o'clock. |
| ·950 | | 7 | ·631 | 70·00 | 69·25 | 68·25 | 1·00 | ·673 | 1· W S W, | ..... | ..... | O. R. M. | Fine misty rain. |
| ·953 | | 8 | ·627 | 70·25 | 69·50 | 68·75 | ·75 | ·685 | 1· S S W, | ..... | ..... | O. R. | Rain from 10 o'clock P. M. |
| ·950 | | 9 | ·621 | 70·00 | 69·00 | 68·00 | 1·00 | ·667 | 1· S S W, | ..... | ..... | O. R. T. L. | Heavy rain and much thunder and lightning from 12½ o'clock. |
| ·953 | ⊙ | 10 | ·645 | 70·00 | 69·50 | 68·75 | ·75 | ·685 | 0·1 E S E, | ..... | K. C. | R. | Calm night. |
| ·907 | | 11 | ·609 | 73·53 | 72·00 | 70·25 | 1·75 | ·712 | 2· S by W, | ..... | K. S. | R. | Fine and clear. |
| 1·000 | | 12 | ·688 | 68·00 | 67·50 | 67·50 | ·00 | ·665 | 3·4 W S W, | ..... | ..... | R. | ..... ..... |
| ·949 | | 13 | ·618 | 68·00 | 67·00 | 66·25 | ·75 | ·629 | 8· E S E, | ..... | ..... | O. R. | Thick rain. |
| ·949 | | 14 | ·655 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 10·11 S W, | ..... | ..... | O. R. U. | Very heavy gale and dark ugly night. |
| 1·000 | | 15 | ·715 | 66·00 | 65·00 | 65·00 | ·00 | ·611 | 10· S by W, | ..... | ..... | O. R. | Heavy rain. |
| 1·000 | | 16 | ·661 | 68·50 | 68·00 | 67·50 | ·50 | ·660 | 11· W S W, | ..... | ..... | R. | Ditto ditto. |
| ·949 | | 17 | ·670 | 68·25 | 67·50 | 67·25 | ·25 | ·656 | 7·9 W S W, | ..... | ..... | R. | Ditto ditto. |
| ·949 | | 18 | ·702 | 67·25 | 66·50 | 65·75 | 1·50 | ·618 | 3· W, | ..... | K. C. S. | R. | Cleared up about 2 o'clock. |
| ·893 | | 19 | ·726 | 64·50 | 63·75 | 62·50 | 1·25 | ·548 | 2· W by N, | ..... | C. K. | V. R. | Clear, a few light clouds. |
| ·893 | | 20 | ·731 | 65·00 | 64·00 | 62·25 | 1·75 | ·539 | 1· W by N, | ..... | K. | R. | Ditto. |
| ·893 | | 21 | ·724 | 64·00 | 63·00 | 61·00 | 2·00 | ·512 | 1· W N N, | ..... | K. | R. | K. on horison, clear. |
| ·893 | | 22 | ·768 | 64·00 | 63·00 | 61·25 | 1·75 | ·520 | 1· W, | ..... | ..... | R. | Very clear. |
| ·897 | | 23 | ·713 | 66·50 | 66·25 | 64·00 | 2·25 | ·568 | 2· W, | ..... | ..... | R. | Ditto. |
| ·949 | | 24 | ·682 | 67·00 | 66·00 | 65·25 | ·75 | ·608 | 1· S by W, | ..... | S. | R. | Clear night. |
| ·946 | | 25 | ·735 | 65·00 | 63·50 | 63·25 | ·25 | ·571 | 2· S by W, | ..... | ..... | R. | Ditto. |
| 1·000 | | 26 | ·771 | 67·00 | 66·00 | 65·75 | ·25 | ·624 | 1· S by W, | ..... | K. S. | R. | Ditto. |
| ·947 | | 27 | ·740 | 66·00 | 65·00 | 64·25 | ·75 | ·588 | 0·1 E, | ..... | ..... | R. | ..... ..... |
| ·949 | | 28 | ·694 | 68·00 | 67·00 | 66·25 | ·75 | ·629 | 1· E, | ..... | ..... | R. | ..... |
| ·897 | | 29 | ·717 | 67·00 | 66·50 | 65·25 | 1·25 | ·604 | 2· S W, | ..... | ..... | R. | Clear star-light. |
| ·907 | | 30 | ·684 | 70·00 | 69·50 | 68·25 | 1·25 | ·670 | 2· S by W, | ..... | ..... | R. | Ditto. |
| ·946 | Means, ... | | 25·680 | 67·89 | 67·07 | 66·23 | ·86 | ·630 | | | | | |

*Poonjee, during September* 1851.

9 O'CLOCK A. M.

| Barometer reduced to 32° Fahr. | Temperature of Mercury. | Temperature of Air. | Temperature of Wet-bulb. | D. | F. | Temperature. Maximum. | Temperature. Minimum. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·678 | 70·00 | 69·25 | 68·75 | ·50 | ·688 | 71·50 | 66·00 | 8· S S W, | 3·420 | ..... | O. R. M. | Heavy rain. | 1 | 1·000 |
| ·699 | 71·25 | 70·25 | 69·75 | ·50 | ·712 | 73·00 | 66·50 | 7·6 S S E, | 1·595 | ..... | R. | ..... | 2 | 1·000 |
| ·704 | 71·00 | 70·00 | 69·25 | ·75 | ·697 | 73·50 | 66·50 | 6· S W, | 1·900 | ..... | O. R. | ..... | 3 | ·953 |
| ·680 | 70·00 | 69·25 | 68·75 | ·50 | ·688 | 71·00 | 67·00 | 8·9 W S W, | 3·915 | ..... | O. R. | ..... | 4 | 1·000 |
| ·729 | 71·00 | 70·25 | 69·50 | ·75 | ·704 | 74·50 | 66·50 | 1·2 S W, | 1·665 | ..... | O. R. | Heavy rain. | 5 | 1·000 |
| ·743 | 72·25 | 71·50 | 70·50 | 1·00 | ·726 | 77·50 | 66·00 | 0·1 S W, | ·225 | K. N. | O. B. | Occasional mist. | 6 | ·953 |
| ·669 | 73·00 | 72·00 | 70·50 | 1·50 | ·721 | 77·00 | 66·00 | 1· S E, | ·195 | K. C. | B. P. | Occasional showers. | 7 | ·953 |
| ·628 | 71·25 | 70·50 | 69·75 | ·75 | ·709 | 74·50 | 67·00 | 1· S S E, | 1·150 | ..... | F. M. R. | Mist and fog. | 8 | ·953 |
| ·606 | 74·00 | 72·50 | 71·75 | ·75 | ·758 | 78·00 | 67·50 | 1· S S W, | ·650 | K. CS. | B. | Clear sunshine. | 9 | ·953 |
| ·644 | 75·00 | 73·75 | 72·25 | 1·50 | ·764 | 77·00 | 67·50 | 0·1 | ·750 | CS. K. | B. | ..... | 10 | ·907 |
| ·697 | 71·00 | 70·50 | 70·00 | ·50 | ·718 | 79·00 | 69·00 | 2· E S E, | 2·870 | ..... | R. D. | Drifting rain and fog. | 11 | ·953 |
| ·754 | 67·00 | 66·50 | 65·25 | 1·25 | ·604 | 70·50 | 65·00 | 4·5 W by S, | 4·295 | ..... | R. | ..... | 12 | ·897 |
| ·688 | 69·00 | 68·00 | 68·00 | ·00 | ·676 | 71·00 | 65·00 | 8·9 W S W, | 5·280 | ..... | O. R. | Heavy rain. | 13 | 1·000 |
| ·752 | 69·00 | 68·00 | 66·50 | 1·50 | ·628 | 68·00 | 65·00 | 11· S W, | 9·795 | ..... | O. R. T. M. | ..... | 14 | ·949 |
| ·750 | 68·75 | 68·00 | 67·25 | ·75 | ·651 | 69·00 | 64·00 | 8· S by W, | 8·235 | ..... | O. R. | ..... | 15 | ·949 |
| ·703 | 67·50 | 67·50 | 66·25 | 1·25 | ·625 | 69·00 | 63·00 | 8· S by W, | 13·190 | ..... | R. | ..... | 16 | ·899 |
| ·740 | 68·50 | 67·25 | 66·75 | ·50 | ·643 | 69·75 | 65·50 | 6· W by S, | 7·190 | ..... | R. M. | ..... | 17 | 1·000 |
| ·768 | 69·25 | 69·00 | 67·25 | 1·75 | ·642 | 69·75 | 63·50 | 3· W by S, | ·140 | K. CS. C. | B. | ..... | 18 | ·902 |
| ·704 | 70·00 | 69·00 | 68·50 | ·50 | ·682 | 72·00 | 63·50 | 2· S E, | ..... | K. C. S | B. | ..... | 19 | 1·000 |
| ·788 | 70·50 | 70·00 | 68·75 | 1·25 | ·681 | 73·50 | 61·00 | 1· N W, | ..... | K. C. S. | B. | ..... | 20 | ·953 |
| ·708 | 70·00 | 69·50 | 68·00 | 1·50 | ·661 | 74·00 | 61·50 | 1· N E, | ..... | C. K. | B. | ..... | 21 | ·907 |
| ·756 | 70·00 | 69·00 | 68·00 | 1·00 | ·667 | 74·00 | 61·00 | 1·0 W, | ..... | K. C. S. | B. | ..... | 22 | ·950 |
| ·703 | 71·00 | 69·50 | 68·25 | 1·25 | ·670 | 76·00 | 64·50 | 2· W, | ..... | C. S. | B. | Clear. | 23 | ·907 |
| ·777 | 72·00 | 70·50 | 68·25 | 2·25 | ·660 | 76·00 | 65·00 | 2· S W, | ..... | C. S. | B. | Ditto. | 24 | ·865 |
| ·848 | 70·00 | 69·00 | 67·25 | 1·75 | ·642 | 75·00 | 64·00 | 1· S W, | ..... | CS. KS. | B. | Bright & clear. | 25 | ·902 |
| ·841 | 71·00 | 70·00 | 68·25 | 1·75 | ·703 | 75·50 | 64·00 | 0·1 E, | ..... | KS. C. | B. | Ditto. | 26 | ·907 |
| ·817 | 70·00 | 70·00 | 68·50 | 1·50 | ·673 | 76·50 | 63·00 | 1· W, | ..... | C. S. | B. | Ditto. | 27 | ·953 |
| ·781 | 72·00 | 70·50 | 68·25 | 2·25 | ·660 | 76·00 | 66·00 | 3· N E, | ..... | K. | B. | Ditto. | 28 | ·865 |
| ·775 | 73·00 | 71·50 | 69·25 | 2·23 | ·683 | 76·50 | 65·00 | 2· W, | ..... | C. S. | B. | Ditto. | 29 | ·865 |
| ·706 | 74·00 | 73·50 | 72·25 | 1·25 | ·767 | 76·00 | 67·50 | 1· S W, | ..... | K. S. C. | B. | Ditto. | 30 | ·907 |
| 25·743 | 70·74 | 69·87 | 68·72 | 1·15 | ·685 | | | | 66·460 | | | | | ·936 |

3 O'CLOCK P. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature Of Mercury. | Temperature Of Air. | Temperature Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ·907 | | 1 | 25·598 | 72·00 | 71·50 | 70·25 | 1·25 | ·717 | 3·4 W by S, | ..... | ..... | D. R. | Drifting rain and mist. |
| ·953 | ☽ | 2 | ·628 | 73·00 | 71·75 | 70·75 | 1·00 | ·732 | 4·5 S S W, | ..... | ..... | O. P. | Partly overcast. |
| ·953 | | 3 | ·618 | 72·00 | 70·75 | 69·75 | 1·00 | 7·08 | 4· S W, | ..... | ..... | O. B. | Partially overcast. |
| ·953 | | 4 | ·595 | 74·00 | 72·50 | 72·00 | ·50 | ·768 | ..... | ..... | K. | B. | Clear and calm. |
| ·908 | | 5 | ·643 | 76·00 | 74·50 | 72·75 | 1·75 | ·775 | 0·1 E, | ..... | ..... | B. | Clear and fine from 12 o'clock. |
| ·908 | | 6 | ·664 | 76·25 | 75·00 | 73·25 | 1·75 | ·804 | 2· E S E, | ..... | K. C. S. | O. B. | Partially overcast. |
| ·953 | | 7 | ·573 | 74·75 | 74·50 | 73·75 | ·75 | ·811 | 2· W by S, | ..... | K. CS. | M. | Misty. |
| ·865 | | 8 | ·544 | 77·75 | 76·00 | 73·25 | 2·75 | ·779 | 1· E S E, | ..... | ..... | B. C. | Clouded over. |
| ·953 | | 9 | ·592 | 78·00 | 76·75 | 75·75 | 1·00 | ·866 | 3· S by W, | ..... | K. CS. | B. | ..... |
| ·909 | ☉ | 10 | ·560 | 78·00 | 77·00 | 75·25 | 1·75 | ·844 | 2· E, | ..... | C. K. | B. | Fine and clear. |
| ·953 | | 11 | ·623 | 70·00 | 69·75 | 69·00 | ·75 | ·691 | 2· S E, | ..... | ..... | O. R. | Continuous rain. |
| ·950 | | 12 | ·694 | 70·00 | 69·00 | 68·25 | ·75 | ·674 | 2·3 S E S, | ..... | ..... | O. P. | Occasionally rain. |
| ·949 | | 13 | ·635 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 6· W, | ..... | ..... | O. R. | Heavy rain. |
| ·949 | | 14 | ·678 | 68·75 | 67·50 | 67·25 | ·25 | ·656 | 7·8 S W, | ..... | ..... | O. R. | Wind has much decreased. |
| ·950 | | 15 | ·674 | 70·00 | 68·75 | 68·25 | ·50 | ·677 | 7· S E, | ..... | ..... | O. R. | ..... |
| ·949 | | 16 | ·678 | 69·00 | 67·75 | 67·25 | ·50 | ·654 | 9· S W, | ..... | ..... | R. | Squally and fresh breeze. |
| ·950 | | 17 | ·680 | 70·00 | 68·50 | 68·25 | ·25 | ·679 | 7·8 W by S, | ..... | ..... | B. C. | Partially clear. |
| ·907 | | 18 | ·681 | 72·00 | 71·00 | 69·25 | 1·75 | ·688 | 2· W by S, | ..... | K. S. | B. F. | Thin fog. |
| ·908 | | 19 | ·688 | 74·75 | 73·25 | 71·25 | 2·00 | ·734 | 2· S E, | ..... | K. SC. | B. | Clear and bright. |
| ·908 | | 20 | ·694 | 74·00 | 73·00 | 70·75 | 2·25 | ·719 | 1·0 | ..... | CS. KS. | B. | Few clouds. |
| ·823 | | 21 | ·718 | 74·00 | 73·50 | 70·50 | 3·00 | ·706 | 5·6 W by S, | ..... | K. | B. | Stiff breeze. |
| ·865 | | 22 | ·710 | 76·00 | 75·00 | 72·25 | 2·75 | ·753 | 1·0 W, | ..... | K. S. C. | B. | Clear and fine. |
| ·865 | | 23 | ·720 | 77·00 | 76·00 | 73·25 | 2·75 | ·779 | 3· S W, | ..... | K. S. | B. | Ditto ditto. |
| ·951 | | 24 | ·659 | 75·00 | 74·00 | 73·25 | ·75 | ·798 | 2· S W, | ..... | K. S. | B. | A few clouds. |
| 865 | | 25 | ·752 | 76·75 | 75·00 | 71·75 | 3·25 | ·734 | 3·4 S by W, | ..... | KS S. | B. | Ditto ditto. |
| ·865 | | 26 | ·776 | 77·00 | 75·50 | 73·25 | 2·25 | ·784 | 1·2 E, | ..... | KS. S | O. B. | Partially overcast. |
| ·908 | | 27 | ·726 | 76·00 | 75·00 | 72·75 | 2·25 | ·770 | 2· S by W, | ..... | CS. S. | B. | Bright sunshine. |
| ·823 | | 28 | ·698 | 77·00 | 75·50 | 72·25 | 3·25 | ·733 | 2· S W, | ..... | CS. KS. | B. | Ditto ditto. |
| ·783 | | 29 | ·702 | 75·75 | 74·00 | 69·25 | 3·75 | ·668 | 2· W, | ..... | CS. | B. | Ditto ditto. |
| ·907 | | 30 | ·678 | 77·75 | 76·00 | 74·25 | 1·75 | ·816 | 2 W, | ..... | K. S. C. | B. | Ditto ditto. |
| ·909 | | Means, ... | 25·663 | 74·05 | 72·87 | 71·27 | 1·63 | ·739 | | | | | |

*September.—(Continued.)*

9 O'CLOCK P. M.

| Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·676 | 70·00 | 69·25 | 68·25 | 1·00 | ·673 | 5· W S W, | ..... | ..... | O. M. P. | Occasional heavy showers. | 1 | ·950 |
| ·704 | 70·50 | 69·75 | 68·75 | 1·00 | ·684 | 8· S S W, | ..... | ..... | O. M. P. | Ditto. | 2 | ·953 |
| ·661 | 71·00 | 69·75 | 69·25 | ·50 | ·700 | 3· S W by S, | ..... | ..... | R. | Heavy rain. | 3 | ·953 |
| ·679 | 71·00 | 70·00 | 69·00 | 1·00 | ·690 | 1· S W, | ..... | ..... | O. M. R. L. | Thick misty rain. | 4 | ·953 |
| ·727 | 71·75 | 70·75 | 69·75 | 1·00 | ·708 | 1· S W, | ..... | K. CS. | B. | Clear moonlight. | 5 | ·953 |
| ·696 | 70·00 | 69·00 | 67·50 | 1·50 | ·651 | 1· N by W, | ..... | C. | B. | Few light cirrus. | 6 | ·950 |
| ·612 | 71·00 | 70·25 | 69·50 | ·75 | ·703 | 1· S by W, | ..... | K. S. | O. M. | Misty and dark. | 7 | 1·000 |
| ·750 | 69·50 | 69·50 | 69·00 | ·50 | ·694 | 0·1 N by W, | ..... | K. C. | B. | Moonlight. | 8 | 1·000 |
| ·661 | 71·75 | 71·00 | 70·00 | 1·00 | ·714 | 1· S S W, | ..... | CS. C. | O. B. | Light C. S., clouds beautifully radiated from N. to S. | 9 | ·953 |
| ·611 | 75·00 | 74·75 | 73·25 | 1·50 | ·791 | 2· S W, | ..... | ..... | B. M. | ..... | 10 | ·908 |
| ·708 | 68·00 | 68·00 | 66·00 | 2·00 | ·612 | 2· S by E, | ..... | ..... | O. R. | ..... | 11 | ·899 |
| ·760 | 67·75 | 66·50 | 66·25 | ·25 | ·634 | 0·7 S W, | ..... | ..... | O. R. | Heavy rain. | 12 | ·949 |
| ·758 | 69·00 | 68·00 | 68·00 | ·00 | ·676 | 10· S by W, | ..... | ..... | O. R. U. | Stiff gale, very dark and threatening aspect. | 13 | 1·000 |
| ·730 | 68·75 | 68·00 | 67·25 | ·75 | ·651 | 10·11 S W, | ..... | ..... | O. R. | Do. but looks better. | 14 | ·949 |
| ·720 | 68·00 | 67·25 | 67·00 | ·25 | ·651 | 7· S by W, | ..... | ..... | R. | Heavy rain still blowing freshly. | 15 | 1·000 |
| ·716 | 69·00 | 68·00 | 68·00 | ·00 | ·676 | 11· S W, | ..... | ..... | R. | Wind very squally. | 16 | 1·000 |
| ·746 | 68·00 | 67·00 | 65·75 | 1·25 | ·614 | 5· W S W, | ..... | K. N. | R. M. | Rain not continuous. | 17 | ·949 |
| ·753 | 66·50 | 65·75 | 64·50 | 1·25 | ·588 | 3· W by S, | ..... | ..... | B. | Clear star-light. | 18 | ·949 |
| ·762 | 68·50 | 67·75 | 66·25 | 1·50 | ·623 | 2· S S E, | ..... | ..... | B. | Ditto. | 19 | ·899 |
| ·764 | 68·50 | 67·75 | 65·75 | 2·00 | ·606 | 1· N W by N, | ..... | K. | B. | K. on horizon, ditto. | 20 | ·899 |
| ·792 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 0·1 N by E, | ..... | ..... | B. | Ditto. | 21 | ·849 |
| ·749 | 71·00 | 70·00 | 68·25 | 1·75 | ·665 | 1· W by N, | ..... | ..... | B. | Clear star-light. | 22 | ·907 |
| ·746 | 70·00 | 69·50 | 68·25 | 1·25 | ·670 | 1· S W, | ..... | ..... | B. | Ditto. | 23 | ·907 |
| ·754 | 69·00 | 68·50 | 67·25 | 1·25 | ·647 | 1· S W, | ..... | ..... | B. | Ditto. | 24 | ·902 |
| ·792 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 1· S W, | ..... | ..... | B. | Ditto. | 25 | ·949 |
| ·802 | 70·00 | 69·50 | 68·25 | 1·25 | ·670 | 1· S E, | ..... | ..... | B. | Ditto. | 26 | ·907 |
| ·808 | 69·75 | 69·50 | 67·75 | 1·75 | ·653 | 0·1 S W, | ..... | ..... | B. | Ditto, | 27 | ·907 |
| ·780 | 70·00 | 69·75 | 68·25 | 1·50 | ·668 | 1·2 W S, | ..... | ..... | B. V. | Very clear ditto. | 28 | ·907 |
| ·727 | 71·00 | 70·50 | 69·25 | 1·25 | ·693 | 1· W, | ..... | ..... | B. | Ditto. | 29 | ·907 |
| ·723 | 73·00 | 72·50 | 71·25 | 1·25 | ·840 | 1· S E, | ..... | C. | F. M. | Thin mist and fog. | 30 | ·908 |
| 25·728 | 69·84 | 69·12 | 68·07 | 1·06 | ·672 | | | | | | | ·937 |

## *Observations made at Cherra*

### 3 O'CLOCK, A. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature. Of Mercury. | Of Air. | Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ·953 | | 1 | 25·665 | 68·00 | 67·25 | 65·75 | 1·50 | ·611 | ..... | ..... | C. | B. | Clear star-light and fine light cirri. |
| ·950 | ☽ | 2 | ·682 | 69·00 | 69·00 | 68·00 | 1·00 | ·667 | 0·1 W by S, | ..... | O. R. | O. R. | Rain from 2½ o'clock. |
| 1·000 | | 3 | ·759 | 67·00 | 66·25 | 66·00 | ·25 | ·629 | 1· N, | ..... | S. | B. | S. about horizon, clear above. |
| ·865 | | 4 | ·727 | 71·00 | 69·50 | 66·75 | 2·75 | ·643 | ..... | ..... | ..... | B. | Calm and very clear. |
| ·823 | | 5 | ·685 | 72·00 | 70·75 | 66·75 | 4·00 | ·610 | 5· E N E, | ..... | S. K. S. | B. | Fine. |
| ·897 | | 6 | ·767 | 67·00 | 67·00 | 65·00 | 2·00 | ·591 | 2· S S E, | ..... | ..... | O. R. | Heavy rain. |
| ·899 | | 7 | ·806 | 68·00 | 67·50 | 66·25 | 1·25 | ·625 | 3·4 S E, | ..... | ..... | O. R. | Rain. |
| ·947 | | 8 | ·723 | 66·00 | 65·00 | 64·25 | 1·75 | ·588 | 7·8 S W, | ..... | ..... | O. R. | Heavy rain. |
| ·949 | | 9 | ·770 | 68·00 | 66·50 | 66·25 | ·75 | ·630 | 4·5 W by S, | ..... | ..... | F. M. R. | Rain and mist. |
| ·897 | ⊙ | 10 | ·771 | 66.75 | 65·75 | 64·25 | 1·50 | ·580 | 6·7 S, | ..... | ..... | O. R. | Heavy rain. |
| ·949 | | 11 | .819 | 67·00 | 66·50 | 65·75 | ·75 | ·618 | 2·3 W by S, | ..... | ..... | R. | Raining. |
| ·949 | | 12 | ·759 | 67·00 | 66·00 | 65·25 | ·75 | ·608 | 8· S, | ..... | ..... | T. R. L. | Thunder and lightning. |
| ·947 | | 13 | ·749 | 66·00 | 65·00 | 64·25 | ·75 | ·587 | 11· S W, | ..... | ..... | R. M. | Blowing very freshly. |
| ·949 | | 14 | ·725 | 66·00 | 65·50 | 64·50 | 1·00 | ·591 | 3· W S W, | ..... | K. N. | O. R. | Rainy and Cloudy. |
| ·949 | | 15 | ·771 | 67·00 | 66·00 | 65·25 | ·75 | ·608 | 2· W S W, | .... . | ..... | O. R. L. | Heavy rain and lightning. |
| ·949 | | 16 | ·817 | 66·00 | 65·50 | 64·75 | ·75 | ·597 | 7·8 W by S, | ..... | ..... | T. L. R. | Severe thunder storm much lightning. |
| ·946 | | 17 | ·794 | 63·00 | 62·50 | 62·00 | ·50 | ·546 | 2· N by E, | ..... | C. K. | B. P. | Clear with passing showers. |
| ·947 | | 18 | ·845 | 65·75 | 65·00 | 64·25 | ·75 | ·587 | 1· W S W, | ..... | S. K. | B. | Fine and clear. |
| ·946 | | 19 | ·840 | 64·00 | 63·50 | 63·25 | ·25 | ·572 | 1·2 S S E, | ..... | C. S. | B. | Thin C. S. |
| ·946 | | 20 | ·819 | 65·00 | 64·25 | 63·25 | 1·00 | ·566 | 1· W by S, | ..... | C. CS. | O. M. B. | Passing showers. |
| 1·000 | | 21 | ·805 | 65·00 | 64·00 | 63·50 | ·50 | ·575 | 1· S W, | ..... | ..... | O. M R. | Overcast and raining. |
| 1·000 | | 22 | ·773 | 65·50 | 63·75 | 63·75 | ·00 | ·585 | 4· S W, | ..... | ..... | O. R. | Thick misty rain. |
| ·946 | | 23 | ·765 | 65·00 | 63·50 | 63·00 | ·50 | ·565 | 10· S W, | ..... | ..... | O. M. R. | Blowing freshly with thick rain. |
| ·946 | | 24 | ·652 | 64·00 | 63·25 | 62·25 | 1·00 | ·547 | 3·4 S E, | ..... | ..... | O. F. R. | Squally with rain. |
| 1·000 | | 25 | ·685 | 61·50 | 61·00 | 60·75 | ·25 | ·524 | 11· S W, | ..... | K. N. | B. | Stiff gale. |
| ·946 | | 26 | 792 | 62·50 | 62·00 | 60·75 | 1·25 | ·515 | 2· W by S, | ..... | K. C. CS. | B. | Cloudy, showers. |
| ·944 | | 27 | ·893 | 60·50 | 60·50 | 59·50 | 1·00 | ·496 | ..... | ..... | CK. | B. | Light clouds on horizon, clear. |
| ·944 | | 28 | ·930 | 57·00 | 56·00 | 54·75 | 1·25 | ·416 | 0·1 N N W, | ..... | ..... | B. | Clear bright star-light. |
| ·844 | | 29 | ·910 | 56·00 | 55·50 | 53·25 | 2·25 | ·384 | 1· N N W, | ..... | ..... . | B. | Very Clear. |
| ·893 | | 30 | ·915 | 58·00 | 57·50 | 56·00 | 1·50 | ·432 | 0·1 N by W, | ..... | C. | B. L. | Occasional flashes of L. in N. E. |
| ·893 | | 31 | ·925 | 59·00 | 58·75 | 56·75 | 2·00 | ·439 | 1· E by N, | ..... | K. KS. | B. | Cloudy. |
| ·906 | Means,... | | 25·785 | 64·05 | 64·19 | 63 09 | 1·14 | ·566 | | | | | |

## *Poonjee during October* 1851.

9 O'CLOCK, A. M.

| Barometer reduced to 32° Faht. | Temperature. Of Mercury. | Of Air. | Of Wet-bulb. | D. | F. | Temperature. Maximum. | Minimum. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | | Humidity, complete saturation being 1000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·737 | 73·00 | 72·00 | 71·00 | 1·00 | ·739 | 77·00 | 60·00 | ..... | ..... | C. CS. | B. | Thin Clouds. | 1 | | ·953 |
| ·760 | 69·00 | 68·25 | 67·50 | ·75 | ·657 | 76·00 | 61·00 | 1· S E, | 1·350 | ..... | R. M. | Thick mist & foggy cloud. | 2 | | 1·000 |
| ·826 | 70·00 | 69·00 | 68·00 | 1·00 | ·667 | 70·50 | 63·50 | 1· N by E, | ·600 | K. CS. | B. | ..... | 3 | | ·950 |
| ·776 | 76·00 | 74·75 | 71·00 | 3·00 | ·719 | 76·00 | 67·00 | 4· S E, | ..... | C. S. | B. | Few light clouds. | 4 | | ·824 |
| ·777 | 73·50 | 72·50 | 71·75 | ·75 | ·758 | 79·75 | 68·50 | 1·0 E, | ..... | KS. CS. | B. | Blowing very freshly. | 5 | | ·953 |
| ..... | ..... | ..... | ..... | ... | ... | ..... | ..... | ..... | ·155 | ..... | ..... | ..... | 6 | | ·000 |
| ·805 | 73·00 | 71·50 | 69·25 | 2·25 | ·683 | 78·75 | 66·50 | 1· E, | ·670 | C. S. | B. | Clear sunshine. | 7 | | ·865 |
| ·860 | 68·00 | 67·50 | 66·75 | ·75 | ·640 | 76·50 | 65·00 | 2· S W, | 3·085 | ..... | O. F. M. | Foggy and overcast. | 8 | | ·949 |
| ·853 | 67·00 | 66·50 | 66·25 | ·25 | ·634 | 70·00 | 66·00 | 4·5 W by S, | 5·680 | ..... | R. F. M. | Ditto. | 9 | | ·949 |
| ·857 | 66·00 | 65·75 | 65·25 | ·50 | ·611 | 71·00 | 65·00 | 1· S, | 6·855 | ..... | R. | Slight rain. | 10 | | ·949 |
| ·860 | 70·00 | 69·50 | 68·00 | 1·50 | ·661 | 71·00 | 65·50 | 1· S, | 2·685 | ..... | R. | Drifting rain. | 11 | | ·997 |
| ·845 | 67·50 | 67·00 | 66·00 | 1·00 | ·623 | 70·00 | 61·00 | 2· S, | 1·410 | ..... | R. | ..... | 12 | | ·949 |
| ·770 | 68·00 | 67·00 | 66·25 | ·75 | ·629 | 69·00 | 60·50 | 1· S W, | 2·530 | ..... | O. T. | Overcast and thunder. | 13 | | ·949 |
| ·702 | 68·50 | 67·25 | 65·75 | 1·50 | ·611 | 79·50 | 61·00 | 6· W S W, | ·800 | K. CS. | B. O. | ..... | 14 | | ·949 |
| ·871 | 67·00 | 66·25 | 65·50 | ·75 | ·613 | 70·00 | 64·00 | 3· S W, | 1·445 | KS. | R. B. | ..... | 15 | | 1·000 |
| ·890 | 68·25 | 67·50 | 66·75 | ·75 | ·640 | 70·00 | 63·50 | 3· S S W, | 2·395 | K. | B. C. | Occasional mist. | 16 | | ·949 |
| ·913 | 68·00 | 67·25 | 66·00 | 1·25 | ·620 | 70·25 | 60·50 | 2· E N E, | ·295 | K. C. | B. | Very fine & clear. | 17 | | ·949 |
| ·905 | 68·00 | 67·50 | 66·75 | ·75 | ·640 | 73·50 | 63·00 | 1· S by E, | ·050 | K. C. | B. | Clear with occasional mist much thunder from 6 to 7 o'clock. | 18 | | ·949 |
| ·920 | 68·00 | 67·25 | 66·50 | ·75 | ·635 | 72·50 | 62·00 | 1· S by E, | ·745 | S. K. | B. C. | ..... | 19 | | 1·000 |
| ·908 | 66·50 | 65·50 | 65·25 | ·25 | ·679 | 71·00 | 61·50 | 1· S by E, | ·680 | C. CS. K. | B. | Very fine. | 20 | | ·950 |
| ·855 | 66·00 | 65·25 | 64·75 | ·50 | ·600 | 70·50 | 61·50 | 1·2 E by S, | 3·365 | KC. CS. | B. | ..... | 21 | | 1·000 |
| ·859 | 67·00 | 66·00 | 65·50 | ·50 | ·616 | 69·50 | 62·00 | 4· W S W, | 2·040 | ..... | F. R. M. | Mist. | 22 | | 1·000 |
| ·829 | 65·00 | 64·00 | 63·25 | ·75 | ·567 | 68·00 | 62·00 | 10·7 S E, | 2·100 | ..... | M. R. | Heavy rain. | 23 | | ·946 |
| ·845 | 64·50 | 63·25 | 61·50 | 1·75 | ·524 | 66·00 | 60·50 | 7· E by S, | 1·195 | K. CS. | C. | Fresh breeze looks threatening. | 24 | | ·946 |
| ·800 | 62·50 | 62·25 | 60·75 | 1·50 | ·512 | 68·00 | 59·50 | 11· W S W, | ·520 | K. | B. | Drifting clouds. | 25 | | ·946 |
| ·808 | 63·00 | 62·50 | 61·25 | 1·25 | ·525 | 66·50 | 58·00 | 2· W by N, | ·225 | K. CS. | B. | Fine. | 26 | | ·946 |
| ·882 | 62·50 | 61·75 | 60·75 | 1·00 | ·517 | 68·50 | 54·50 | 2·3 W N W, | ..... | K. | B. | ..... | 27 | | ·946 |
| ·886 | 62·25 | 61·75 | 60·00 | 1·75 | ·497 | 67·00 | 53·00 | 1 W N W, | ·390 | ..... | B. | Cloudless. | 28 | | ·893 |
| ·884 | 63·00 | 62·50 | 60·75 | 1·75 | ·570 | 68·50 | 52·50 | 1·2 W by W, | ..... | K. KS. | B. | ..... | 29 | | 1·000 |
| ·885 | 63·00 | 62·25 | 60·50 | 1·75 | ·566 | 68·50 | 52·50 | 2· E N E, | ..... | K. | B. | ..... ..... | 30 | | ·893 |
| ·904 | 63·25 | 62·50 | 60·25 | 2·25 | ·496 | 67·50 | 54·50 | 1·2 E, | ..... | C. CS. | B. | ..... | 31 | | ·843 |
| 25·858 | 67·34 | 66·56 | 65·59 | 1·14 | ·611 | | | | 41·265 | | | | | | ·946 |

*Observations during*

**3 O'CLOCK P. M.**

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ·907 | | 1 | 25·662 | 75·50 | 74·25 | 72·00 | 2·25 | ·751 | 0·1 | ..... | K. CS. | O. F. | Overcast and foggy. |
| ·940 | ☽ | 2 | ·708 | 68·50 | 67·75 | 67·00 | ·75 | ·646 | 2· S E, | ..... | ..... | R. M. | Mist. |
| ·907 | | 3 | ·716 | 75·00 | 73·75 | 71·50 | 2·25 | ·738 | 1· N by E, | ..... | K. | B. | Occasional clouds. |
| ·825 | | 4 | ·673 | 79·50 | 78·50 | 74·50 | 4·00 | ·802 | 1· E, | ..... | K. | B. | Fine and clear. |
| ·865 | | 5 | ·727 | 72·50 | 71·50 | 68·50 | 3·00 | ·658 | 4· E by S, | ..... | S. CK. | O. B. | Clear to East, overcast. |
| ·000 | | 6 | ..... | ..... | ..... | ..... | ... | ... | ..... | ..... | ..... | ..... | ..... |
| ·865 | | 7 | ·752 | 76·00 | 75·00 | 72·25 | 3·25 | ·748 | 1· S W, | ..... | S. CK. | B. | Thin clouds. |
| ·950 | | 8 | ·786 | 70·00 | 69·00 | 68·25 | ·75 | ·609 | 2· S W, | ..... | ..... | R. | Drifting rain. |
| ·950 | | 9 | ·754 | 70·00 | 68·50 | 67·75 | ·75 | ·597 | 4· S by W, | ..... | ..... | R. M. | Ditto, misty. |
| ·950 | ☉ | 10 | ·786 | 70·25 | 69·25 | 68·25 | 1·00 | ·673 | 2· S by W, | ..... | ..... | R. B. | Drifting showers. |
| ·950 | | 11 | ·764 | 69·75 | 68·50 | 68·00 | ·50 | ·328 | 3·4 W by S, | ..... | C. | B. | Clear and sunny. |
| ·902 | | 12 | ·710 | 69·00 | 68·50 | 67 25 | 1·25 | ·647 | 3· S W, | ..... | ..... | R. F. | Rain and slight fog. |
| ·949 | | 13 | ·748 | 68·50 | 67·00 | 66·25 | ·75 | ·564 | 2· S W, | ..... | ..... | R. M. | Rain and mist. |
| ·902 | | 14 | ·734 | 69·00 | 68·50 | 66·75 | 1·75 | 632 | 2· W by S, | ..... | ..... | B. O. | Cloudy. |
| ·949 | | 15 | ·790 | 69·00 | 68·00 | 66·75 | 1·25 | ·636 | 2· S W, | ..... | ..... | O. | ..... |
| ·902 | | 16 | ·930 | 69·75 | 69·00 | 66·75 | 1·25 | ·358 | 5· W by S, | ..... | K. N. | M. R. P. | Misty with showers. |
| ·823 | | 17 | ·802 | 74 00 | 72 50 | 69·25 | 2·25 | ·684 | 2· S W, | ..... | C. S. | B. | Fine and clear. |
| ·953 | | 18 | ·799 | 71·00 | 70·00 | 69·25 | ·75 | ·632 | 1· S W, | ..... | ..... | R. | Overcast and raining. |
| ·949 | | 19 | ·838 | 68·50 | 67·75 | 67·25 | ·50 | 611 | 2· E S E, | ..... | K. C. | B. C. | Cloudy. |
| ·949 | | 20 | ·801 | 67 00 | 66·50 | 66·00 | ·50 | ·584 | 1· S, | ..... | ..... | B. R. | Heavy rain after 12½. |
| 1·000 | | 21 | ·760 | 68·00 | 67·25 | 67·00 | ·25 | 633 | 2·3 S W, | .. ... | K. C. | O. M. B. | Passing showers. |
| ·946 | | 22 | ·789 | 65·50 | 64·25 | 63·25 | 1·00 | ·565 | 10· S W, | ..... | ..... | R. | Blowing hard, wind fell about 5½. |
| ·946 | | 23 | ·736 | 64·75 | 64·00 | 63·25 | ·75 | ·567 | 8·0 S S W, | ..... | ..... | M. F. | Rain ceased about 2½ o'clock. |
| ·949 | ☾ | 24 | ·597 | 68·00 | 67·25 | 65·75 | 1·50 | ·611 | 4· S by W, | ..... | ..... | O. M. C. | Cloudy but no rain. |
| ·898 | | 25 | ·745 | 66·00 | 65·00 | 63·00 | 2·00 | ·550 | 4· S by W, | ..... | CS. S. | B. | Clear sunshine. |
| ·853 | | 26 | ·832 | 67·50 | 66·50 | 64·25 | 2·25 | ·573 | 4·5 W by S, | ..... | K. CK. | B. | Clear above, hoary clouds on horizon. |
| ·944 | | 27 | ·926 | 62·00 | 61·50 | 59·75 | 1·75 | ·492 | 1· E, | ..... | ..... | O. R. | Heavy rain. |
| ·854 | | 28 | ·894 | 69·00 | 68·00 | 65·25 | 2·75 | ·589 | 2· S W, | ..... | C. CS. | B. | ..... |
| ·860 | | 29 | ·876 | 67·00 | 66·50 | 62·75 | 3·25 | ·533 | 1· | ..... | C. | B. | Clear and bright. |
| ·810 | - | 30 | ·884 | 67·75 | 66·50 | 63·25 | 3·25 | ·543 | 2· E, | ..... | CS. K. | B. | Ditto. |
| ·810 | | 31 | ·914 | 70·00 | 68 50 | 64·75 | 3·75 | ·568 | 1· E S E, | ..... | K. | B. | Ditto. |
| ·882 | Means.... | | 25·780 | 69·61 | 68·33 | 66·39 | 1·74 | 624 | | | | | |

*October.—(Continued.)*

9 O'CLOCK P. M.

| Barometer reduced to 32° Fahr. | Temperature. Of Mercury. | Of Air. | Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Whether. | Remarks. | Date. | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25·728 | 70·50 | 69·75 | 68·50 | 1·25 | ·675 | 1· W S W, | ..... | K. N. | O. R. | Heavy rain with L, from 6½ to 8, cloudy. | 1 | ·953 |
| ·793 | 67·25 | 66·50 | 65·75 | ·75 | ·618 | 0· S W, | ..... | ..... | R. M. | Foggy mist. | 2 | ·949 |
| ·767 | 71·00 | 69·75 | 67·75 | 2·00 | ·650 | ..... | ..... | ..... | R. | Very clear moon and star-light. | 3 | ·907 |
| ·735 | 72·50 | 72·00 | 70·50 | 1·50 | ·720 | 1· E, | ..... | K. | R. | Clear, occasional L in West. | 4 | ·953 |
| ·798 | 69·50 | 69·00 | 66·25 | 2·75 | ·611 | 3·4 E N E, | ..... | S. | ..... | Thin covering of stratus. | 5 | ·854 |
| ·816 | 70·00 | 69·50 | 68·25 | 1·25 | ·670 | 2· E by S, | ..... | ..... | R. | Clear moon-light. | 6 | ·907 |
| ·848 | 69·00 | 68 75 | 67·25 | 1·50 | ·645 | 2· S, | ..... | ..... | D. R. | Drifting rain. | 7 | ·902 |
| ·830 | 68·00 | 67·50 | 66·75 | ·75 | ·575 | 3· W by S, | ..... | ..... | R. | Slight rain. | 8 | ·949 |
| ·793 | 66·50 | 66·00 | 65·25 | ·75 | ·543 | 7· W, | ..... | ..... | R. M. | Rain and mist, foggy. | 9 | ·949 |
| ·852 | 66·00 | 65·25 | 64·75 | ·50 | ·557 | 2·4 S, | ..... | ..... | R. | Overcast with heavy clouds. | 10 | 1·000 |
| ·850 | 67·00 | 66·75 | 65·25 | 1·50 | ·602 | 1·0 S, | ..... | ..... | R. | Fine clear moon-light rain commenced at 9½. | 11 | ·897 |
| ·817 | 67·00 | 66·00 | 65·00 | 1·00 | ·602 | 2· S W, | ..... | ..... | R. | Clear moon-light. | 12 | ·949 |
| ·745 | 66·00 | 65·50 | 64·00 | 1·50 | ·576 | 3· W by S, | ..... | ..... | R. | Bright clear moon-light. | 13 | ·897 |
| ·795 | 75·50 | 66·50 | 65·50 | 1·00 | ·612 | 4· S W, | ..... | K. N. | R. R. | Passing showers. | 14 | ·949 |
| ·838 | 68·00 | 67·25 | 66·25 | 1·00 | ·628 | 6· W S W, | ..... | K. N. | R. | Thunder and lightning, after 3 o'clock, heavy rain, at 5 o'cl., 2 slight earth-quake shocks, | 15 | ·949 |
| ·870 | 65·00 | 64·75 | 64·25 | ·50 | ·547 | 3· W by S, | ..... | C. K. | R. P. | Clear with passing showers. | 16 | ·947 |
| ·869 | 67·00 | 66·75 | 66·00 | ·75 | ·559 | 2· E N E, | ..... | S. | R. L. | Light stratus, bright meteor from pleiades at 4 5° to horizon. | 17 | ·949 |
| ·872 | 68·00 | 66·00 | 65·25 | ·75 | ·632 | 3· W by S, | ..... | N. S. | R. | Heavy rain from 8¼ o'clock. | 18 | ·949 |
| ·913 | 65·75 | 65·25 | 64·50 | ·75 | ·527 | 1· W S W, | ..... | C. CK. | O. R. | Cloudy, few stars. | 19 | 1·000 |
| ·873 | 66·00 | 65·00 | 64·75 | ·25 | ·584 | 1· S S W, | ..... | ..... | O. R. C. | Misty and cloudy. | 20 | 1·000 |
| ·814 | 64·50 | 63·75 | 63·75 | ·00 | ·585 | 1·0 S W, | ..... | ..... | O. R. | Rain, fresh breeze. | 21 | 1·000 |
| ·829 | 65·00 | 64·00 | 63·00 | 1·00 | ·561 | 3· S W, | ..... | ..... | O. M. R. | Thick misty rain. | 22 | ·946 |
| ·745 | 65·00 | 64·00 | 63·25 | ·75 | ·567 | 4· S S W, | ..... | ..... | O. F. R. | Dark cloudy night. | 23 | ·949 |
| ·671 | 65·00 | 64·25 | 63·00 | 1·25 | ·558 | 8· S S W, | ..... | ..... | O. R. | Heavy rain, fresh breeze. | 24 | ·946 |
| ·792 | 62·50 | 62·00 | 60·00 | 2·00 | ·494 | 2· W by S, | ..... | K. CK. | O. R. P. | Cloudy, a few stars visible, showers. | 25 | ·893 |
| ·894 | 58·00 | 57·00 | 54·75 | 2·25 | ·406 | 2· W by N, | ..... | C. K. | R. L. | Clear star-light, much L in North as from 2 balls of light. | 26 | ·891 |
| ·961 | 59·00 | 58·75 | 57·25 | 1·50 | ·452 | 1· N W, | ..... | C. CS. | R. | ..... | 27 | ·893 |
| ·937 | 59·00 | 58·75 | 56·50 | 1·75 | ·446 | 1· N W, | ..... | C. CS. | R. | Clear and calm. | 28 | ·842 |
| ·923 | 59·50 | 59·25 | 57·25 | 2·00 | ·447 | 1· N by W, | ..... | CS. | R. | Light CS. clouds. | 29 | ·893 |
| .958 | 58·00 | 57·50 | 55·50 | 2·00 | ·419 | 1· E N E, | ..... | C. CS. | R. | Clear and bright. | 30 | ·893 |
| .977 | 61 00 | 60·50 | 58·00 | 2·50 | ·466 | 1· E by S, | ..... | C. | R. | Clear moon-light. | 31 | ·843 |
| 25·836 | 66·83 | 64·95 | 63·64 | 1·22 | ·566 | | | | | | | ·926 |

## *Observations made at Cherra*

### 3 O'CLOCK A. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ☽ | 1 | 25·036 | 59·00 | 58·75 | 56·25 | 2·50 | ·427 | 5·1 E, | ..... | ..... | B. V. | Very clear, no clouds. |
| | | 2 | ·936 | 59·00 | 59·00 | 56·25 | 2·75 | ·424 | 1· N, | ..... | ..... | B. | Light C. on S. horizon. |
| | | 3 | ·868 | 57·00 | 57·50 | 55·25 | 2·25 | ·414 | 1· E N E, | ..... | C. | B. | Clear light cirrus. |
| | | 4 | ·798 | 56·00 | 55·75 | 53·25 | 2·50 | ·482 | 1· E S E, | ..... | C. CS. | B. | Light covering of C. and CS. |
| | | 5 | ·821 | 56·50 | 56·25 | 53·50 | 2·75 | ·382 | 0·1 N E, | ..... | C. | B. | Very clear, no clouds. |
| | | 6 | ·816 | 55·00 | 54·75 | 53·25 | 1·50 | ·391 | 1· N by E, | ..... | ..... | B. | Cloudless clear. |
| | | 7 | ·810 | 56·00 | 55·50 | 54·25 | 1·25 | ·409 | 1· N N W, | ..... | K. C. | B. | Few light clouds. |
| | | 8 | ·775 | 55·00 | 54·55 | 52·25 | 1·25 | ·380 | 1· N N E, | ..... | C. S. | B. | Clear. |
| | ⊙ | 9 | ·799 | 61·00 | 60·00 | 57·00 | 3·00 | ·434 | 1· W N W, | ..... | C. S. | B. | Cloudy. |
| | | 10 | ·836 | 58·50 | 58·25 | 57·00 | 1·25 | ·451 | 1· W by N, | ..... | CK. CS. | B. | Clear mackerel-back sky. |
| | | 11 | ·848 | 58·50 | 58·25 | 57·25 | 1·00 | ·457 | 1· N N E, | ..... | ..... | B. | Very clear. |
| | | 12 | ·808 | 57·00 | 57·00 | 55·75 | 1·25 | ·431 | 1· N N E, | ..... | ..... | B. | Very clear K. on horizon. |
| | | 13 | ·813 | 54·00 | 53·75 | 52·50 | 1·25 | ·383 | 0·1 N E, | ..... | C. CS. | B. | Thin clouds on horizon. |

### 3 O'CLOCK P. M.

| Humidity, complete saturation being = 1·000. | Moon's phases. | Date. | Barometer reduced to 32° Faht. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ☽ | 1 | 25·894 | 70·00 | 69·00 | 68·25 | ·75 | ·673 | 1· E, | ..... | C. K. | B. | Very bright sun-shine. |
| | | 2 | ·901 | 69·50 | 68·25 | 64·75 | 3·50 | ·570 | 2· E S E, | ..... | C. CS. K. | B. | Very fine. |
| | | 3 | ·815 | 69·75 | 68·75 | 64·25 | 4·50 | ·551 | 1· E, | ..... | C. S. | B. | Fine clear sun-shine. |
| | | 4 | ·762 | 70·00 | 68·50 | 66·25 | 2·25 | ·615 | 1· S, | ..... | C. K. | B. | Clear sun-shine. |
| | | 5 | ·815 | 69·00 | 68·50 | 64·25 | 4·25 | ·553 | 1· W S W, | ..... | K. | B. | Very fine. |
| | | 6 | ·784 | 69·50 | 69·00 | 64·75 | 4·25 | ·564 | 0·1 S by W, | ..... | K. CS. | B. | Fine. |
| | | 7 | ·789 | 69·50 | 68·50 | 65·25 | 3·25 | ·584 | 2· S by E, | ..... | K. | B. | ..... |
| | | 8 | ·788 | 64·75 | 64·00 | 62·25 | 1·75 | ·539 | 1· N by W, | ..... | KS. K. | B. | Cloudy, over-cast, dropping rain. |
| | ⊙ | 9 | ·785 | 67·00 | 66·75 | 64·00 | 2·75 | ·563 | 3· S W, | ..... | C. S. K. | B. | Partly over-cast. |
| | | 10 | ·858 | 70·00 | 70·00 | 67·25 | 2·75 | ·632 | 2· W by S, | ..... | K. CS. K. | B. | ..... |
| | | 11 | ·829 | 69·50 | 69·00 | 65·25 | 3·75 | ·579 | 4· S by E, | ..... | K. | B. | Clear and bright. |
| | | 12 | ·806 | 67·00 | 68·00 | 65·75 | 2·25 | ·604 | 3· N N E, | ..... | K. CS. | Cloudy. | Misty. |
| | | 13 | ·795 | 66·00 | 65·00 | 63·25 | 1·75 | ·558 | 2· S, | ..... | K. CS. | B. | Partially over-cast. |

*Poonjee, during November* 1851.

9 O'CLOCK A. M.

| Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Temperature. | | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Of Mercury. | Of Air. | Of Wet-bulb. | | | Maximum. | Minimum. | | | | | | | | |
| 26·009 | 66·75 | 64·75 | 59·25 | 5·50 | ·447 | 64·00 | 59·00 | 1· S E, | ..... | K. | B. | Clear. | 1 | | |
| ·011 | 65·50 | 64·50 | 60·25 | 4·25 | ·476 | 70·00 | 56·50 | 2· E S E, | ..... | C. | B. | Very fine. | 2 | | |
| 25·904 | 65·00 | 63·75 | 59·50 | 4·25 | ·463 | 70·50 | 54·00 | 1· N by E, | ..... | C. CS. | B. | Fine. | 3 | | |
| ·875 | 66·00 | 64·75 | 61·25 | 3·50 | ·502 | 69·50 | 54·00 | 1·2 S E, | ..... | C. | B. | Clear sun-shine. | 4 | | |
| ·886 | 62·50 | 62·25 | 59·75 | 2·50 | ·485 | 71·00 | 52·50 | 1· E by N N E, | ..... | ..... | B. | Very clear. | 5 | | |
| ·872 | 63·00 | 62·00 | 58·75 | 3·25 | ·460 | 69·50 | 52·00 | 0·1 N by E, | ..... | K. | B. | Few clouds. | 6 | | |
| ·873 | 61·50 | 61·25 | 59·75 | 1·50 | ·494 | 70·50 | 53·00 | 1· E, | ..... | K. CS. | B. | Light clouds . | 7 | | |
| ·845 | 62·00 | 61·25 | 59·25 | 2·00 | ·481 | 65·00 | 54·00 | 2· N E, | ..... | KS. K. | ..... | Cloudy. | 8 | | |
| ·860 | 62·50 | 62·00 | 58·50 | 3·50 | ·453 | 70·50 | 50·00 | 1· N, | ..... | CS. K. | B. | ..... | 9 | | |
| ·929 | 64·50 | 64·00 | 62·25 | 1·75 | ·539 | 68·00 | 56·50 | 2· E by S, | ..... | C. CK. | B. | Light & clear. | 10 | | |
| ·908 | 63·00 | 62·75 | 61·25 | 1·50 | ·522 | 70·50 | 56·00 | 2· E by S, | ..... | ..... | B. | Very few clouds. | 11 | | |
| ·861 | 62·00 | 61·50 | 59·75 | 1·75 | ·492 | 70·00 | 54·00 | 2· N E, | ..... | K. C. | B. | ..... | 12 | | |
| ·886 | 63·00 | 61·25 | 59·25 | 2·00 | ·481 | 68·50 | 50·50 | 1· S by E, | ..... | KC. SC. | B. | ..... | 13 | | |

9 O'CLOCK P. M.

| Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. | Date. | | Humidity, complete saturation being = 1·000. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Of Mercury. | Of Air. | Of Wet-bulb. | | | | | | | | | | |
| 25·964 | 60·00 | 61·00 | 58·75 | 2·25 | ·469 | 1· N, | ..... | ..... | B. | Bright clear night. | 1 | | |
| ·902 | 63·00 | 61·75 | 58·25 | 3·50 | ·449 | 1· W by S, | ..... | CK. KS. | B. | Fine upper clouds from W. by S. | 2 | | |
| ·830 | 59·00 | 58·75 | 56·25 | 2·50 | ·427 | 1· E S E, | ..... | C. CS. | B. | Bright covering of C. and CS., | 3 | | |
| ·842 | 59·50 | 59·00 | 54·25 | 4·75 | ·374 | 0·1 S E, | ..... | ..... | B. | Very clear, no clouds. | 4 | | |
| ·853 | 57·00 | 57·00 | 54·50 | 2·50 | ·400 | 1· N by E, | ..... | ..... | B. | Cloudless, clear. | 5 | | |
| ·844 | 58·00 | 57·75 | 55·25 | 2·50 | ·412 | 1· N N W, | ..... | C. | B. | Few clouds, colored halo round moon 6° diam. | 6 | | |
| ·850 | 60·50 | 60·25 | 58·75 | 1·50 | ·477 | 0·1 S E, | ..... | CS. | B. | Light C. S. | 7 | | |
| ·831 | 62·00 | 60·50 | 57·25 | 2·25 | ·445 | 1· W by S, | ..... | CK. | B. | Moon-light. | 8 | | |
| ·840 | 61·00 | 60·75 | 59·25 | 1·50 | ·486 | 0·1 W by N, | ..... | CK. K. | B. | Clear bright moon-light. | 9 | | |
| ·884 | 63·00 | 62·50 | 61·25 | 1·25 | ·525 | 1· E by N, | ..... | CK. K. | B. | Clear moon-light. | 10 | | |
| ·829 | 59·00 | 59·25 | 57·75 | 1·50 | ·460 | 1· N by E, | ..... | K. | B. | Very clear, K. on horizon. | 11 | | |
| ·799 | 68·00 | 57·75 | 56·25 | 1·50 | ·436 | 1· N E, | ..... | K. | B. | Very clear, some K. in East on horizon. | 12 | | |
| ·858 | 63·00 | 64·00 | 62·50 | 1·50 | ·545 | ..... | ..... | ..... | ..... | ..... | 13 | | |

## *Hourly Observations taken at*

JUNE 21ST AND 22ND.

| Date. | Hour. | Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Of Mercury. | Of Air. | Of Dew point. | | | | | | | |
| 21st, | 6 | 25·747 | 70·50 | 69·45 | 66·50 | ... | ·688 | 1· S by E, | ..... | S. C. | O. M. | Moist grass 70·25, diffused clouds over sky, break to S. E. and N. E. |
| | 7 | ·755 | 70·25 | 70·25 | 66·50 | ... | ·688 | ..... | ..... | C. KS. | B. M. | Misty rain at ½ past 6, patches of blue sky. |
| | 8 | ·766 | 71·00 | 70·25 | 67·25 | .. | ·705 | ..... | ..... | ..... | O. M. | Thick diffused mist. |
| | 9 | ·790 | 74·50 | 71·00 | 68·00 | ... | ·722 | 1· S by E, | ..... | ..... | O. M. | Thick misty clouds over all, about 150 feet above ground. |
| | 10 | ·793 | 73·25 | 71·75 | 70·00 | ... | ·770 | 0·1 S by E, | ..... | ..... | P. O. B. | Slight passing showers. |
| | 11 | ·791 | 74·25 | 73·00 | 68·50 | ... | ·735 | 0·1 S S W / E by S | ..... | ..... | B. O. | Bright with drift clouds. |
| | 12 | ·790 | 74·30 | 74·50 | 71·00 | ... | ·796 | 1· S by E, | ..... | ..... | B. | Ditto ditto. |
| | 13 | ·753 | 77·50 | 76·50 | 70·50 | ... | ·783 | 1· S by W, | ..... | ..... | B. | Drifting clouds 300 feet from ground. |
| | 14 | ·749 | 77·00 | 75·50 | 71·50 | ... | ·809 | 1· S by E, | ..... | ..... | B. O. P. | Drizzling since 1 o'clock. |
| | 15 | ·738 | 75·20 | 73·60 | 71·50 | ... | ·809 | 1· S by E, | ..... | ..... | B. O. P. | Very slight passing showers, black bulb 75·50. |
| | 16 | ·720 | 76·75 | 75·25 | 71·00 | ... | ·796 | 1· S W, | ..... | K. S. | B. | Clear and bright. |
| | 17 | ·716 | 76·50 | 74·50 | 68·50 | ... | ·735 | 1· W, | ..... | C. K. | B. | Ditto ditto black bulb, Ther. in sun 82° 00. |
| | 18 | ·722 | 75·50 | 73·75 | 69·00 | ... | ·745 | 1· E S E, / E, | ..... | C. CK. | B. | Ditto ditto light C. in patches. |
| | 19 | ·727 | 73·75 | 72·50 | 69·00 | ... | ·745 | 1· S. by E, | ..... | CK. CS. | B. | CK. in W. CS. on horizon. |
| | 20 | ·746 | 72·00 | 71·75 | 69 00 | ... | ·745 | 0·1 S by E, | ..... | C. | B. | Clear star-light night, cirri towards W. |
| | 21 | ·783 | 69·75 | 69·40 | 67·50 | ... | ·710 | 1· S by E, | ..... | C. | ..... | Slightly hazy. |
| | 22 | ·785 | 69·25 | 68·75 | 67·75 | ... | ·715 | ..... | ..... | ..... | B. | ..... ..... |
| | 23 | ·783 | 68·50 | 68·40 | 68·00 | ... | ·722 | ..... | ..... | ..... | B. | Clear, bright star-light. |
| | 24 | ·775 | 68·00 | 67·60 | 67·75 | ... | ·715 | ..... | ..... | C. | B. | Fine star-light night, halo round moon. |
| 22nd, | 1 | ·769 | 67·50 | 67·00 | 67·50 | ... | ·710 | ..... | ..... | ..... | B. | Few clouds near horizon. |
| | 2 | ·751 | 67·00 | 65·50 | 67·25 | ... | ·705 | ..... | ..... | CK. | B. | Ther. exposed on grass 66°, halo continues not so marked. |
| | 3 | ·742 | 67·00 | 66·00 | 67·25 | ... | ·705 | 0·1 S by E, | ..... | CK. | B. M. | Ditto misty and thick. |
| | 4 | ·743 | 66·25 | 66·00 | 66·00 | ... | ·699 | 1·2 S by E, | ..... | ..... | B. | Clear, fine light clouds in West. |
| | 5 | ·739 | 66·00 | 66·00 | 66·00 | ... | 678 | 2· N by W, | ..... | C. CS. CK. | B. | C. above, CS. CK. below, C. S. in West. |
| | 6 | ·751 | 67·00 | 66·75 | 66·00 | ... | ·678 | 2· N W, | ..... | C. K. | B. | C. above, K. below. |
| Means,..... | | 25·757 | 71·54 | 70·60 | 68·39 | | ·732 | | | | | |

The fine passing showers on the 21st left no trace in the rain gauge. At 9 P. M. of the 21st, two shooting stars were seen passing from about 20° below the zenith through the Great Bear towards the N. W., and at 10 o'clock P. M. one was seen passing to the West from an elevation of about 50°. Its course was nearly vertical and seen for about 15 degrees. The 24 hours have been calm and fine. Maximum 76·75: Minimum 66·00.

## *Cherra Poonjee*, 1851.

JULY 21ST AND 22ND.

| Date, | Hour. | Barometer reduced to 32° Faht. | Temperature Of Mercury. | Temperature Of Air. | Temperature Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21st, | 6 | 25·715 | 67·50 | 67·25 | 67·50 | ... | ·710 | 3· S. W, | ..... | ..... | O. R. | Thick small heavy rain, all over-cast. |
| | 7 | ·732 | 67·50 | 67·25 | 67·50 | ... | ·710 | 3· S W, | ..... | ..... | R. | Ditto ditto. |
| | 8 | ·734 | 68·00 | 67·50 | 67·25 | ... | ·705 | 4·5 S W, | ..... | ..... | R. O. | Wind increases. |
| | 9 | ·743 | 67·25 | 66·75 | 67·00 | .. | ·699 | 4· S W, | 2·825 | ..... | R. O. | Maximum 69·75, Minimum 65·50 |
| | 10 | ·739 | 67·25 | 66·50 | 67·00 | ... | ·699 | 3· S W, | ..... | ..... | R. M. O. | Rain lighter. |
| | 11 | ·734 | 68·75 | 68·25 | 68·00 | ... | ·722 | 3· S W, | ..... | ..... | R. M. O. | Rain continues. |
| | 12 | ·711 | 68·50 | 67·75 | 68·00 | ... | ·722 | 3· S W, | 0·520 | ..... | M. D. R. | Ditto lighter. |
| | 13 | ·690 | 69·75 | 68·75 | 68·50 | ... | ·733 | 2· S W, | ..... | ..... | M. D. R. | Ditto ditto. |
| | 14 | ·672 | 70·00 | 69·25 | 68·50 | ... | ·733 | 2· S W, | ..... | ..... | M. R. O. | Ditto ditto. |
| | 15 | ·650 | 69·00 | 68·25 | 68·50 | ... | ·733 | 2· S W, | 0·500 | ..... | M. R. O. | Mist and rain continue. |
| | 16 | ·638 | 69·25 | 68·50 | 68·75 | ... | ·739 | 3· S W, | ..... | ..... | M. R. O. | Ditto. |
| | 17 | ·639 | 69·50 | 68·75 | 68·50 | ... | ·733 | 2· W S W, | ..... | ..... | M. R. D. | Ditto. |
| | 18 | ·640 | 67·50 | 66·75 | 67·00 | ... | ·699 | 3· W by S, | 0·275 | ..... | M. R. D. | Wind a little fresher. |
| | 19 | ·656 | 67·00 | 66·50 | 67·00 | ... | ·699 | 3· W by S, | ..... | ..... | M. D. R. | ..... |
| | 20 | ·673 | 67·50 | 66·75 | 67·00 | ... | ·699 | 2·3 W by S, | ..... | ..... | M. D. R. | Wind lighter. |
| | 21 | ·671 | 67·00 | 66·50 | 66·00 | ... | ·678 | 1· W S W, | 0·145 | ..... | O. | Very dark, rain ceased. |
| | 22 | ·677 | 66·50 | 66·00 | 66·00 | ... | ·678 | 1· W S W, | ..... | ..... | R. | Heavy rain. |
| | 23 | ·681 | 67·00 | 66·75 | 67·00 | ... | ·699 | 1· W S W, | ..... | ..... | R. | Heavy rain. |
| | 24 | ·665 | 66·75 | 66·00 | 65·50 | ... | ·667 | 2·3 W by S, | 3·075 | ..... | R. | Heavy and continuous rain. |
| 22nd, | 1 | ·659 | 66·50 | 65·75 | 65·75 | ... | ·672 | 2· W S W, | ..... | ..... | R. | Ditto ditto. |
| | 2 | ·646 | 67·00 | 66·50 | 66·00 | ... | ·678 | 2· W by S, | ..... | ..... | R. | Ditto ditto. |
| | 3 | ·624 | 67·50 | 67·00 | 67·00 | ... | ·699 | 1· W by S, | 2·885 | ..... | R. O. | Ditto ditto. |
| | 4 | ·620 | 66·75 | 66·50 | 66·50 | ... | ·688 | 1· W by S, | ..... | ..... | O. | Heavy and thick, but not raining. |
| | 5 | ·619 | 66·50 | 66·25 | 66·50 | ... | ·688 | 1·0 W S W, | ..... | ..... | O. M. R. | Thick mist and cloud. |
| | 6 | ·622 | 66·75 | 66·25 | 66·75 | ... | ·693 | 1· W by S, | 1,570 | ..... | M. R. | Ditto ditto. |
| Means, | | 25·674 | 67·70 | 67·13 | 67·15 | | ·793 | | 11·795 | | | |

The 24 hours have been almost incessantly wet, 11·795 inches having fallen between 6 A. M. of the 21st and 6 A. M. of the 22nd. Sky over-cast throughout with constant drifting clouds. About 8 A. M. of the 21st it looked threatening and stormy, but the wind did not freshen much, and afterwards nearly died away. Maximum temperature of air 69·00, Minimum 65·75.

## *Hourly Observations taken at*

AUGUST 21st AND 22nd.

| Date. | Hour. | Barometer reduced to 32° Fahr. | Temperature: Of Mercury. | Temperature: Of Air. | Temperature: Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21st, | 6 | 25·729 | 67·50 | 67·00 | 67·00 | ·00 | ·654 | 6· W S W, | ..... | ..... | O. R. M. | ..... |
| | 7 | ·744 | 68·00 | 67·25 | 67·25 | .00 | ·659 | 5· W S W, | ..... | ..... | R. M. | Misty rain. |
| | 8 | ·755 | 67·75 | 67·25 | 67·25 | ·00 | ·659 | 4·5 W S W, | ..... | ..... | R. M. | Ditto. |
| | 9 | ·764 | 68·75 | 68·00 | 67·50 | ·50 | ·660 | 7· S, | ·300 | ..... | R. | Maximum 69·00, Minimum 65, blowing freshly. |
| | 10 | ·770 | 68·75 | 67·90 | 67·25 | ·65 | ·653 | 7· S S W, | ..... | ..... | R. | Continuous rain, but not heavy. |
| | 11 | ·766 | 68·50 | 68·00 | 67·25 | ·75 | ·651 | 6·7 S S W, | ..... | ..... | R. | Ditto. |
| | 12 | ·750 | 68·75 | 68·00 | 67·75 | ·25 | ·668 | 6·7 W S W, | ..... | ..... | R. | Ditto. |
| | 13 | ·730 | 69·00 | 68·25 | 67·75 | ·50 | 665 | 6·7 S W, | ..... | ..... | R. | Ditto. |
| | 14 | ·710 | 69·00 | 68·25 | 67·75 | ·50 | ·665 | 6· S S W, | ..... | ..... | R. | Ditto. |
| | 15 | ·702 | 69·75 | 68·75 | 68·00 | ·75 | ·669 | 6· W by S, | ..... | ..... | R. | Ditto. |
| | 16 | ·690 | 69·75 | 68·75 | 67·75 | 1·00 | ·661 | 4· S W, | ..... | ..... | R. | Ditto. |
| | 17 | ·680 | 69·50 | 68·50 | 67·75 | ·75 | ·662 | 4· S W, | ..... | ..... | R. | Ditto, but lighter. |
| | 18 | ·686 | 68·75 | 68·00 | 66·75 | 1·25 | ·636 | 3·4 W by S, | ..... | ..... | O. R. | Rain ceased about 5, still over-cast. |
| | 19 | ·707 | 67·75 | 67·50 | 66·75 | ·75 | ·640 | 3· W by S, | ..... | N. K. C. | O. R. | *A few stars visible. |
| | 20 | ·727 | 67·75 | 67·50 | 66·75 | ·75 | ·640 | 3· W, | ..... | K. | R. | Star-light night. |
| | 21 | ·744 | 67·50 | 67·25 | 66·75 | ·50 | ·643 | 2· W by S, | ·775 | ..... | O. | Clouds about horizon, all over-cast and dark. |
| | 22 | ·750 | 68·00 | 67·50 | 66·75 | ·75 | ·640 | 2· W S W, | ..... | ..... | O. R. | Thick small rain. |
| | 23 | ·756 | 68·00 | 67·50 | 66·75 | ·75 | ·640 | 2· W S W, | ..... | ..... | O. M. | Cloudy and over-cast. |
| | 24 | ·760 | 68·00 | 67·25 | 66·50 | ·75 | ·635 | 1·2 W by S, | ..... | ..... | O. | Ditto. |
| 22nd, | 1 | ·746 | 68·00 | 67·00 | 66·25 | ·75 | ·629 | 1·2 W S W, | ..... | ..... | O. M. | Ditto and foggy. |
| | 2 | ·735 | 67·75 | 67·00 | 66·00 | 1·00 | ·623 | 2· W by S, | ..... | ..... | O. M. | Dark and threatening. |
| | 3 | ·721 | 67·50 | 66·50 | 65·75 | ·75 | ·618 | 3·2 W S W, | ..... | N. K. | O. M. | Drizzly mist. |
| | 4 | ·721 | 67·50 | 66·75 | 65·75 | 1·00 | ·617 | 2· W S W, | ..... | CK. CS. | O. | Partially over-cast. |
| | 5 | ·731 | 67·00 | 66·50 | 65·75 | ·75 | ·618 | 2· W by S, | ..... | N. CS. S. | ..... | Fine bright streaks. |
| | 6 | ·749 | 67·00 | 66·75 | 65·75 | 1·00 | ·617 | 2·3 W S W, | ..... | K. C. S. N. | R. | ..... |
| **Means,.....** | | **25·733** | **68·22** | **67·56** | **66·90** | **·65** | **·645** | | **1·075** | | | |

**A fresh breeze continued during the greater part of the 21st, which lulled towards evening. Of rain, there were 1·075 inches during the 24 hours: the slight mist which continued for some time on the morning of the 22nd, not being traceable in the Pluviometer. The 24 hours have been heavy, over-cast and dark.**

## *Cherra Poonjee*, 1851.

SEPTEMBER 21ST AND 22ND.

| Date. | Hour. | Barometer reduced to 32° Faht. | Temperature Of Mercury. | Temperature Of Air. | Temperature Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21st, | 6 | 25·742 | 64·75 | 64·25 | 62·75 | 1·50 | ·550 | 1· W by N, | ..... | C. | B. | Light cirrus, clear and fine morning. |
| | 7 | ·767 | 66·00 | 65·00 | 63·25 | 1·75 | ·558 | 1· W by N, | ..... | C. | B. | ..... |
| | 8 | ·790 | 68·50 | 67·50 | 65·25 | 2·25 | ·594 | ..... | ..... | C. K. | B. | Light clouds, mist rising from valley. |
| | 9 | ·708 | 70·00 | 69·50 | 68·00 | 1·50 | ·661 | 1· N E, | ..... | C. K. | B. | Maximum 69·75, Minimum 61·50. |
| | 10 | ·703 | 71·50 | 70·75 | 69·25 | 1·50 | ·690 | 1· E S E, | ..... | C. K. | B. | Light cirrus and mist from valley. |
| | 11 | ·789 | 72·50 | 72·00 | 69·75 | 2·25 | ·695 | 1· E S E, | ..... | K. C. | B. | Slightly clouded. |
| | 12 | ·778 | 74·50 | 73·00 | 70·75 | 2·25 | ·719 | 2· W by S, | ..... | K. C. | B. | Ditto. |
| | 13 | ·754 | 75·00 | 73·75 | 71·25 | 2·50 | ·730 | 4· W by S, | ..... | K. C. | B. | Wind freshening. |
| | 14 | ·736 | 75·25 | 74·00 | 71·25 | 2·75 | ·727 | 4· W, | ..... | K. | B. | ..... |
| | 15 | ·718 | 74·00 | 73·50 | 70·25 | 2·00 | ·715 | 5·6 W by S, | ..... | K. | F. | ..... |
| | 16 | ·708 | 74·00 | 73·00 | 70·75 | 2·25 | ·719 | 1· W N W, | ..... | K. | B. | ..... |
| | 17 | ·709 | 73·75 | 72·75 | 70·75 | 2·00 | ·721 | 1· N, | ..... | K. | B. | ..... |
| | 18 | ·716 | 72·25 | 71·50 | 69·75 | 1·75 | ·700 | 1· N by E, | ..... | K. | B. | Heavy clouds about horizon. |
| | 19 | ·736 | 70·25 | 69·50 | 68·25 | 1·25 | ·670 | 1· N E, | ..... | K. C. | B. | ..... |
| | 20 | ·760 | 69·50 | 68·75 | 67·75 | 1·00 | ·661 | 0·1 N by E, | .... | ..... | B. | Clear star-light. |
| | 21 | ·792 | 69·00 | 68·00 | 67·25 | ·75 | ·651 | 0·1 N by E, | ..... | ..... | B. | Ditto. |
| | 22 | ·800 | 69·00 | 68·25 | 67·25 | 1·00 | ·650 | 0·1 N by E, | ..... | ..... | B. | Ditto. |
| | 23 | ·736 | 68·00 | 67·50 | 66·25 | 1·75 | ·625 | ..... | ..... | ..... | B. | Ditto. |
| | 24 | ·793 | 67·00 | 65·25 | 63·25 | 2·00 | ·555 | 1· W, | ..... | ..... | B. | Ditto. |
| 22nd, | 1 | ·789 | 65·50 | 64·25 | 62·00 | 2·25 | ·529 | 1· W, | ..... | ..... | B. | Ditto. |
| | 2 | ·780 | 64·00 | 63·00 | 61·25 | 1·75 | ·520 | 1·2 W by N, | ..... | C. | B. | A few clouds on horizon to West. |
| | 3 | ·766 | 64·00 | 63·00 | 62·00 | 1·00 | ·542 | 1· W, | ..... | ..... | B. | Ditto. |
| | 4 | ·760 | 63·50 | 62·75 | 61·75 | 1·00 | ·537 | 1· W, | ..... | ..... | B. | Fine clear morning. |
| | 5 | ·756 | 63·00 | 62·50 | 60·50 | 2·00 | ·503 | 1· W by N, | ..... | ..... | B. | Ditto, light cirrus. |
| | 6 | ·774 | 62·75 | 62·00 | 60·00 | 2·00 | ·494 | 1· W by N, | ..... | ..... | B. | Light cirrus. |
| Means, | | 25·764 | 69·10 | 68·21 | 66·43 | 1·76 | ·629 | | | | | |

The 24 hours have been very fine, clear sun-shine and star-light, Maximum of Thermometer in air 74·25, Minimum 62·00.

## *Hourly Observations taken at Cherra Poonjee.*

**OCTOBER 21ST AND 22ND.**

| Date. | Hour. | Barometer reduced to 32° Faht. | Temperature. Of Mercury. | Of Air. | Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21st, | 6 | 25·808 | 64·00 | 63·50 | 63·00 | ·50 | ·522 | 1· W S W, | ..... | ..... | O. R. | Heavy rain. |
| | 7 | ·840 | 63·75 | 63·25 | 63·00 | ·25 | ·549 | 2· W S W, | ..... | ..... | O. R. | Ditto ditto. |
| | 8 | ·850 | 64·50 | 64·00 | 63·50 | ·50 | ·532 | 1· S E, | ..... | ..... | O. R. | Lighter and clearer. |
| | 9 | ·855 | 66·00 | 65·25 | 64·75 | ·50 | ·557 | 1·2 E by S, | ·750 | K. C. C. S. | B. | Maximum 70·50, Minimum 61·50. |
| | 10 | ·849 | 67·75 | 66·75 | 66·25 | ·50 | ·589 | 2· S, | ..... | K. N. | O. C. | ..... |
| | 11 | ·844 | 68·50 | 67·50 | 67·00 | ·50 | ·606 | 2·3 S by W, | ..... | ..... | O. C. | Thin covering of clouds. |
| | 12 | ·813 | 67·00 | 66·25 | 66·25 | ·00 | ·637 | 4·5 S S W, | ·075 | K. C. | B. C. | ..... |
| | 13 | ·794 | 69·25 | 68·00 | 67·75 | ·25 | ·649 | 3· S W, | ..... | K. | M. R. P. | ..... |
| | 14 | ·770 | 68·00 | 67·25 | 67·00 | ·25 | ·633 | 5·6 S W, | ..... | C. S. | O. M. B. | Passing showers. |
| | 15 | ·760 | 68·00 | 67·25 | 67·00 | ·25 | ·633 | 2·3 S W, | ·145 | K. C. | O. M. B. | Ditto. |
| | 16 | ·759 | 67·75 | 67·00 | 66·75 | ·25 | ·667 | 3· W, | ..... | K. | M. B. | Ditto misty. |
| | 17 | ·765 | 67·00 | 66·50 | 66·50 | ·00 | ·643 | 3·4 S W, | ..... | ..... | O. R. | Heavy rain. |
| | 3 | ·771 | 65·00 | 64·75 | 64·75 | ·00 | ·605 | 4· S W, | ·675 | ..... | O. R. | ..... |
| | 19 | ·785 | 66·00 | 65·00 | 64·75 | ·25 | ·584 | 5· S W, | ..... | ..... | O. R. | Wind freshening. |
| | 20 | ·801 | 65·00 | 64·50 | 64·50 | ·00 | ·600 | 7· S W, | ..... | ..... | O. R. M. | Ditto ditto. |
| | 21 | ·814 | 64·50 | 63·75 | 63·75 | ·00 | ·585 | 1·0 S W, | ·890 | ..... | O. R. | Ditto heavy rain. |
| | 22 | ·808 | 64·00 | 63·75 | 63·50 | ·25 | ·559 | 8· S S W, | ..... | ..... | O. R. | Rain continuous but lighter. |
| | 23 | ·808 | 64·50 | 64·00 | 63·75 | ·25 | ·564 | 4· W S W, | ..... | ..... | O. M. R. | Ditto. |
| | 24 | ·802 | 64·50 | 64·00 | 63·75 | ·25 | ·564 | 3· W S W, | ..... | S. | O. M. R. | Thin covering of S. |
| 22nd, | 1 | ·793 | 65·00 | 63·75 | 63·75 | ·00 | ·585 | 3·4 W S W, | ..... | S. | O. M. | A few stars visible. |
| | 2 | ·779 | 65·00 | 64·00 | 63·75 | ·25 | ·564 | 6· S W, | ..... | ..... | O. R. | Thick misty rain. |
| | 3 | ·775 | 65·50 | 63·75 | 63·75 | ·00 | ·585 | 4· S W, | ..... | ..... | O. R. | Ditto ditto. |
| | 4 | ·775 | 65·50 | 64·50 | 64·25 | ·25 | ·574 | 3·4 S W, | ..... | ..... | R. | Heavy rain. |
| | 5 | ·783 | 65·50 | 64·25 | 64·00 | ·25 | ·569 | 2· S S W, | ..... | ..... | R. F. | Fog and cloud. |
| | 6 | ·787 | 65·00 | 64·25 | 63·50 | ·75 | ·507 | 1· S S W, | 1·150 | ..... | F. E. R. | Foggy and rainy. |
| **Means,** | | **25·800** | **65·86** | **55·07** | **64·82** | **·25** | **·586** | | **3·685** | | | |

**With short intervals, the 24 hours have been rainy, clouded and over-cast. In the evening of the 21st a stiff breeze sprung up from the S. W. but did not continue more than a few hours. The Maximum Temperature of the air was 68·0, the Minimum 63·00.**

## *General Summary.*

| MONTH. | Barometric Pressure. | | | Barometric Range in 24 hours. | | | Temperature. | | | Range of Thermometer in 24 hours. | | | F. or Force of Aqueous Vapour. | | | Rain. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum. | Minimum. | Mean. | Maximum. | Minimum. | Mean. | Maximum. | Minimum. | Mean. | Maximum. | Minimum. | Mean. | Maximum. | Minimum. | Mean. | Total Fall. |
| July, ..... | 25·786 | 25·525 | 25·670 | ·153 | ·039 | ·096 | 81·00 | 65·00 | 70·04 | 9·75 | 1·00 | 5·38 | ·973 | ·604 | ·796 | 96·280 |
| August, ..... | 25·779 | 25·543 | 25·668 | ·119 | ·037 | ·078 | 70·50 | 66·00 | 70·08 | 9·50 | 1·00 | 5·25 | ·938 | ·608 | ·701 | 88·540 |
| September, ..... | 25·848 | 25·544 | 25·703 | ·200 | ·050 | ·128 | 77·00 | 63·00 | 69·73 | 12·00 | ·25 | 6·13 | ·866 | ·512 | ·647 | 66·460 |
| October, ..... | 25·904 | 25·591 | 25·815 | ·135 | ·022 | ·065 | 78·50 | 57·00 | 66·08 | 10·00 | 0·50 | 4·79 | ·802 | ·384 | ·592 | 41·265 |
| November to the 13th,... | 26·011 | 25·775 | 25·853 | ·115 | ·062 | ·087 | 71·00 | 50·00 | 61·90 | 14·25 | 6·75 | 11·04 | ·673 | ·374 | ·485 | 0·000 |

N. B. The Maximum, Minimum and Mean Thermometer readings given above, are from a discussion of the whole readings of the month four times each day. The results given by the Maximum and Minimum Thermometers are as follow:

| MONTH. | Mean Maximum. | Mean Minimum. | Maximum. | Minimum. | Mean. | Maximum daily Range. | Minimum daily Range. |
|---|---|---|---|---|---|---|---|
| July, ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... |
| August, ..... | 74·39 | 65·85 | 82·00 | 64·00 | 73·00 | 14·75 | 4·50 |
| September, ..... | 73·78 | 65·17 | 79·00 | 61·00 | 70·00 | 13·50 | 3·00 |
| October, ..... | 71·34 | 61·35 | 79·75 | 52·50 | 66·25 | 18·50 | 4·00 |
| November, ..... | 60·04 | 54·00 | 70·50 | 50·00 | 60·25 | 18·50 | 5·00 |

*Hourly Observations taken at*

JULY 21ST AND 22ND.

| Date. | Hour. | Barometer reduced to 32° Fahr. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Of Mercury. | Of Air. | Of Wet-bulb. | | | | | | | |
| 21st, | 6 | 25·749 | 65·75 | 66·00 | 66·00 | ·0 | ·632 | 3· S S E, | ..... | C. CS. | O. M. R. | Heavy driving mist. |
| | 7 | ·762 | 66·50 | 67·00 | 66·75 | ·25 | ·645 | 3· W by N, | ..... | CS. | R. O. M. | A little bright in S. and E. |
| | 8 | ·772 | 66·50 | 66·75 | 66·50 | ·25 | ·640 | 4· W by N, | ..... | ..... | O. M. R. | Heavy rain. |
| | 9 | ·789 | 67·00 | 67·00 | 66·75 | ·25 | ·645 | 5·6 W S W, | ..... | ..... | O. M. R. | Ditto ditto. |
| | 10 | ·787 | 66·60 | 66·75 | 66·75 | ·0 | ·648 | 8·9 W S W, | ..... | ..... | O. M. R. | Ditto squally stiff breeze. |
| | 11 | ·777 | 67·40 | 68·00 | 67·70 | ·30 | ·667 | 7·8 W S W, | ..... | CS. | O. M. | Clearer and brighter. |
| | 12 | ·764 | 69·00 | 69·75 | 69·50 | ·25 | ·708 | 6· W S W, | ..... | CS. | O. | Thinly over-cast clearer and less wind. |
| | 13 | ·752 | 69·40 | 69·50 | 69·00 | ·50 | ·695 | 3· W N W, | ..... | ..... | O. M. R. | Heavy rain thickly over-cast. |
| | 14 | ·740 | 68·60 | 69·00 | 68·50 | ·50 | ·684 | 4·5 W by S, | ..... | ..... | O. M. R. | Ditto ditto. |
| | 15 | ·726 | 69·00 | 69·00 | 68·50 | ·50 | ·684 | 5· S W, | 1·575 | ..... | O. M. R. | Ditto ditto. |
| | 16 | ·716 | 68·00 | 68·25 | 67·75 | ·50 | ·665 | 5·6 S by W, | ..... | ..... | O. M. R. | Ditto ditto. |
| | 17 | ·722 | 67·50 | 68·00 | 67·20 | ·80 | ·651 | 6· S S W, | ..... | ..... | O. R. | Heavy rain. |
| | 18 | ·738 | 67·50 | 67·00 | 67·00 | ·0 | ·654 | 6· S S W, | ..... | ..... | R. | ..... |
| | 19 | ·746 | 67·00 | 69·00 | 67·00 | ·0 | ·654 | 5·7 S S W, | ..... | ..... | M. R. | Misty rain, squally. |
| | 20 | ·763 | 66·75 | 67·50 | 67·00 | ·50 | ·650 | 5· S S W, | ..... | ..... | R. | ..... |
| | 21 | ·773 | 65·75 | 67·00 | 66·50 | ·50 | ·639 | 4· S by W, | ..... | ..... | M. R. | Rain continuous but a little lighter. |
| | 22 | ·786 | 66·00 | 67·00 | 67·00 | ·0 | ·654 | 4· S by W, | 4·625 | ..... | O. M. R. | Thick misty rain. |
| | 23 | ·778 | 66·00 | 66·50 | 66·50 | ·0 | ·643 | 6· S by W, | ..... | ..... | M. R. | Ditto ditto squally. |
| | 24 | ·763 | 65·50 | 65·50 | 65·50 | ·50 | ·621 | 3· S by W, | ..... | ..... | R. | Heavy rain. |
| 22nd, | 1 | ·747 | 64·50 | 65·50 | 64·50 | ·50 | ·596 | 5· S S W, | ..... | ..... | R. | Very heavy rain. |
| | 2 | ·731 | 65·50 | 66·50 | 66·50 | ·0 | ·643 | 6·7 S W by S, | ..... | ..... | ..... | Ditto. |
| | 3 | ·721 | 66·50 | 66·50 | 66·50 | ·0 | ·643 | 5·6 S W by S, | ..... | ..... | R. | Ditto. |
| | 4 | ·723 | 66·25 | 66·50 | 66·50 | ·0 | ·643 | 9·10 W S W, | ..... | ..... | R. V. | Ditto blowing very freshly. |
| | 5 | ·737 | 65·75 | 66·25 | 66·25 | ·0 | ·638 | 9 S W by S, | ..... | ..... | R. | ..... |
| | 6 | ·743 | 66·40 | 67·50 | 66·75 | ·25 | ·646 | 6 S W by S, | ..... | ..... | ..... | ..... |
| Means,..... | | ·752 | 66·83 | 67·31 | 67·37 | ·42 | ·651 | | | | | |

## *Cherra Poonjee*, 1852.

**AUGUST 21ST AND 22ND.**

| Date. | Hour. | Barometer reduced to 32° Faht. | Temperature | | | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Of Mercury. | Of Air. | Of Wet-bulb. | | | | | | | |
| 21st, | 6 | 25·798 | 67·75 | 67·75 | 66·75 | 1·00 | ·639 | 1·0 S by E, | ..... | C. Cs. | M. | Drifting mist nearly calm. |
| | 7 | ·820 | 68·50 | 68·50 | 68·00 | ·50 | ·671 | 0· | ..... | ..... | O. M. | Thick mist. |
| | 8 | ·841 | 69·00 | 70·50 | 69·00 | 1·50 | ·685 | 0·1 S, | ..... | C. S. | M. | Ditto. |
| | 9 | ·868 | 70·00 | 71·00 | 69·50 | 1·50 | ·697 | 1· S by W, | ..... | ..... | R. | Over-cast with heavy rain. |
| | 10 | ·884 | 68·75 | 69·00 | 68·00 | 1·00 | ·667 | 1·2 S by W, | ..... | C. S. | R. | Heavy rain. |
| | 11 | ·875 | 69·00 | 69·00 | 67·75 | 1·25 | ·659 | 1·2 S by W, | ..... | C. S. | O. M. R. | ..... |
| | 12 | ·852 | 70·00 | 70·50 | 68·75 | 1·75 | ·676 | 2· S by W, | 0·260 | K.C. Cs. | O. M. B. | Clear to E. and S. |
| | 13 | ·833 | 71·75 | 72·00 | 70·00 | 2·00 | ·704 | 2· S by W, | ..... | K. C. | O. | ..... |
| | 14 | ·813 | 71·75 | 71·75 | 70·00 | 1·75 | ·706 | 2·1 S by W, | ..... | K. C. | B. | Partly over-cast, partly clear. |
| | 15 | ·795 | 72·25 | 72·75 | 71·00 | 1·75 | ·731 | 1· | ..... | K. C. | O. B. | ..... |
| | 16 | ·772 | 72·50 | 72·50 | 71·00 | 1·50 | ·734 | 0·1 | ..... | C. S. | O. M. | Thick foggy mist. |
| | 17 | ·760 | 71·75 | 72·00 | 71·00 | 1·00 | ·739 | 1·0 | ..... | C. S. | O. | Ditto. |
| | 18 | ·766 | 70·75 | 70·50 | 69·00 | ·50 | ·695 | 1· S by W, | ..... | C Cs. | O. | Thick mist. |
| | 19 | ·798 | 68·50 | 68·50 | 67·50 | 1·00 | ·656 | 1· | ..... | C S. | O. B. | A few patches of b. |
| | 20 | ·827 | 68·25 | 69·00 | 68·00 | 1·00 | ·667 | 1·0 | ..... | K. Cs. | O. M. | Misty and thick. |
| | 21 | ·840 | 68·00 | 68·50 | 67·00 | 1·50 | ·649 | 1· | ..... | K. Cs. | O. | ..... |
| | 22 | ·859 | 67·75 | 68·00 | 67·00 | 1·00 | ·645 | 0· | ..... | K. Cs. | O. | Over-cast clear to S. S. E. |
| | 23 | ·866 | 67·75 | 68·00 | 67·25 | ·75 | ·653 | 1· | ..... | ..... | O. M. | ..... |
| | 24 | ·866 | 68·00 | 68·00 | 67·00 | 1·00 | ·645 | 0·1 S by W, | ..... | K. | O. M. | Still over-cast. |
| 22nd, | 1 | ·861 | 67·50 | 68·50 | 67·50 | 1·00 | ·656 | 0·1 S by W, | ..... | ..... | O. M. R. | Raining. |
| | 2 | ·857 | 67·50 | 68 00 | 67 50 | ·50 | ·660 | 1· S S W, | ..... | ..... | R. | Ditto. |
| | 3 | ·844 | 67·50 | 68·00 | 67·50 | ·50 | ·660 | 1· S S W, | ..... | ..... | R. | Heavy rain. |
| | 4 | ·861 | 67·25 | 67·50 | 67·00 | ·50 | ·649 | 1·0 | ..... | ..... | R. | Ditto. |
| | 5 | ·871 | 67·50 | 67·25 | 67·00 | ·25 | ·652 | ..... | ..... | ..... | M. R. | ..... |
| | 6 | ·878 | 68·25 | 69·00 | 68·00 | 1·00 | ·667 | 2· S by W, | ..... | ..... | M. R. | ..... |
| **Means,.....** | | **25·836** | **69·10** | **69·52** | **68·00** | **1·08** | **·674** | | | | | |

## *Hourly Observations taken at Cherra Poonjee* 1852.

SEPTEMBER 21ST AND 22ND.

| Date. | Hour. | Barometer reduced to 32° Fahr. | Temperature. Of Mercury. | Of Air. | Of Wet-bulb. | D. | F. | Wind. | Rain. | Cloud. | Weather. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 21st, | 6 | 25·662 | 67·25 | 67·50 | 67·50 | ... | ·665 | 11· W S W, | ..... | ..... | O. M. R. | Heavy rain. |
| | 7 | ·675 | 67·50 | 67·20 | 67·20 | ... | ·636 | 10·11 W S W, | 9·875 | ..... | O. M. R. | Heavy rain, very stiff gale. |
| | 8 | ·734 | 64·50 | 64·50 | 65·00 | ... | ·611 | 10·9 W S W, | ..... | ..... | O. M. | Rain, much less wind, lighter and a little more to the W. |
| | 9 | ·764 | 64·75 | 65·00 | 65·00 | ... | ·611 | 9· W by S, | ..... | ..... | M. | Rain lighter. |
| | 10 | ·796 | 65·20 | 65·50 | 65·50 | 1·00 | ·612 | 8·9 W by S, | ..... | ..... | M. | Slight rain and mist. |
| | 11 | ·776 | 65·75 | 66·50 | 66·75 | ... | ·649 | 8·9 W by S, | ..... | ..... | M. | Rainy and cloudy. |
| | 12 | ·798 | 66·75 | 67·00 | 67·00 | ... | ·654 | 8·7 W by S, | ..... | ..... | O. M. | Misty cloud. |
| | 13 | ·789 | 67·50 | 68·00 | 68·00 | ... | ·676 | 7· W by S, | ..... | C. K. | M. | Looks clearer. |
| | 14 | ·773 | 68·50 | 68·75 | 68·50 | 0·25 | ·685 | 7· W by S, | ..... | C. CS. | ..... | Misty and cloudy, but not raining. |
| | 15 | ·767 | 68·75 | 69·00 | 68·75 | 0·25 | ·691 | 7· W, | 0·520 | C. CS. | O. M. | Misty and over-cast. |
| | 16 | ·759 | 68·50 | 68·75 | 68·50 | 0·25 | ·685 | 7·8 W, | ..... | C. S. | O. M. R. | Thick misty cloud. |
| | 17 | ·769 | 68·50 | 68·50 | 68·50 | ... | ·687 | 5·6 W, | ..... | C. S. | M. | Thick mist. |
| | 18 | ·781 | 68·75 | 68·75 | 68·75 | ... | ·693 | 6·7 W, | ..... | ..... | O. M. R. | Heavy rain. |
| | 19 | ·783 | 68·50 | 69·20 | 69·00 | 0·20 | ·698 | 5· W, | ..... | ..... | R. | Heavy rain. |
| | 20 | ·795 | 67·50 | 68·00 | 68·00 | ... | ·676 | 5·4 W, | ..... | C. S. | M. O. | Not raining, but misty. |
| | 21 | ·818 | 67·50 | 68·00 | 68·00 | ... | ·676 | 5·4 W, | ..... | ..... | M. O. | Not raining but misty. |
| | 22 | ·832 | 67·50 | 68·00 | 68·00 | ... | ·676 | 4·3 W.WbyN, | ..... | ..... | O. M. R. | Rain thick and heavy. |
| | 23 | ·836 | 67·50 | 68·00 | 68·00 | ... | ·676 | 4·3 W, | ..... | ..... | O. M. | Thick mist, l. |
| | 24 | ·822 | 67·50 | 68·00 | 68·00 | ... | ·676 | 4· W by N, | ..... | ..... | O. M. R. | Misty thick rain and cloud. |
| 22nd, | 1 | ·819 | 67·50 | 67·75 | 67·75 | ... | ·671 | 3·4 W, | ..... | ..... | M. R. | Thick misty rain, occasional l. |
| | 2 | ·803 | 67·50 | 67·75 | 67·75 | ... | ·671 | 3·4 | ..... | ..... | M. R. | Heavy rain, thunder at 2¼. |
| | 3 | ·795 | 67·50 | 67·75 | 67·75 | ... | ·671 | 3·4 W by N, | ..... | ..... | O. R. | Heavy rain. |
| | 4 | ·789 | 67·10 | 67·75 | 67·50 | 0·25 | ·663 | 3· W by N, | ..... | ..... | M. R. | Heavy rain. |
| | 5 | ·808 | 66·25 | 66·50 | 66·50 | ... | ·643 | 3· W by N, | ..... | C. S. K. | M. R. | Clouds a little broken. |
| | 6 | ·809 | 66·00 | 66·50 | 66·50 | ... | ·643 | 3· | 1·420 | C. S. R. | M. R. | Blue sky in North. |
| Means,..... | | ·781 | 67·20 | 67·52 | 67·51 | 0·36 | ·6 4 | | | | | |

# APPENDIX C.

## ON THE LANGUAGE AND ETHNOLOGY OF THE KHASIS.

THE peculiar position of the country inhabited by the Khasis; their connection on the one side with the Bengalli groups which dwell in the plains of Sylhet, Tipperah and Mymensing, and on the other side with the Assamese; their close propinquity to the very remarkable race of the Garos on the West, (a propinquity, which is nevertheless accompanied by a total absence of any intermixture by marriage, and only a very slight intercourse in the way of commerce) and their intimate relation on their Eastern border, with the Cachari (Bodo?) the Nagas and the Mishmi, and so with the true Indo-Chinese borderers; all combined to render the study of their language, their habits and customs one of great interest. The daily increasing interest attached to the relations of these Indo-Chinese borderers with the other great groups also pointed out the Khasi, as a tribe likely to afford many valuable points of comparison.

The earliest notice I have been able to find of the language and character of the Khasi (Cossia), is in a brief paper published in 1831, in which the author refers to the remarkable monumental stones, which are so numerous throughout the Hills, and of which a rude representation is given.(*a*)

The Rev. W. Lish, for some time Missionary at Cherra Poonjee, published in 1838, (*b*) a brief, but valuable account of the Khasis, at the close of which he gives a summary of the principal peculiarities of the language. It is, however, so concise and limited as to afford little aid in tracing out the relations of the tongue.

In 1849, Mr. Robinson (of Assam) published some valuable notes "on the languages spoken by the various tribes inhabiting the valley of Assam, and its mountain confines," (*c*) among which the Khasi, or Kassia, was of course included. Mr. Robinson gave a brief outline of the grammar and construction of the language, drawn up from information furnished by the Rev. T. Jones of Cherra Poonjee, accompanied by a short vocabulary of the tongue. In the majority of its statements, this paper is correct.

The most recent account of this tribe, with which I am acquainted, is in a paper signed W., published in March 1852, also founded on the papers of the Rev. T. Jones, but accom-

(*a*) *Gleanings in Science*, vol. iii, p. 172, signed C.

(*b*) *Calcutta Christian Observer*, March 1838, p. 125.

(*c*) *Journal Asiatic Society, Bengal*, March and April 1849, Nos. cci., ccii.

panied by many original remarks referring to the habits and customs of the people. The author does not, however, enter on the structure of the language at all. (*d*)

As many of the statements in these papers are correct, but are intermixed with what appear to me to be incorrect views and erroneous deductions, I shall, in what follows, endeavour to combine all the information I have been able to obtain without specially referring to these papers, either to correct what may be erroneous, or confirm what appears to be correct.

And as preliminary to all other inquiries, I shall give a brief account of the structure of the Khasi language or dialect, and a vocabulary of all the words I have been able to ascertain. Any more general remarks on the peculiar customs of the tribe, some of which are remarkably interesting, I shall reserve for another occasion. (*e*)

I am also obliged to defer any remarks on the relations of the language, the elements of which are here given. Constantly occupied in other pursuits, and without the necessary works of reference for such inquiries, I feel that such remarks would possess but little value. And these relations can be traced out by others who may never have visited these Hills, as well as by those who have.

Proceeding therefore, at once, to the investigation of the language spoken by the Khasi tribe, it is first needful very briefly to explain the letters used, and the sounds expressed by such letters, in transferring to a written form the words or tones employed by this tribe. And first, therefore, of the orthography of the language. (*f*)

ORTHOGRAPHY.—The Khasis possessing no books, no written language and no alphabet, it is consequently optional for any inquirer, who may endeavour to render intelligible to others the sounds used by this tribe as descriptive of objects or actions, to adopt any known

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(*d*) *Calcutta Christian Observer*, March 1852, p. 119. I believe the author is the Revd. William Pryse, Missionary at Sylhet.

(*e*) I take this opportunity of expressing the obligations I am under to the Reverend Wm. Lewis, of Cherra Poonjee, for most valuable aid in obtaining a knowledge of the Khasi language. Mr. and Mrs. Lewis have been resident at Cherra since 1843, in connexion with the Welsh Calvinistic Methodist Missions, and have both acquired an excellent knowledge of the Khasi tongue, which enables them to converse freely with the Natives. I would also bear the warmest testimony to the great and beneficial influence which their quiet energy and unobtrusive piety have exercised, and continue to exercise, over the Natives of the Hills. Their admirably-conducted Schools, (both for boys and girls) are at the same time rearing up a generation trained in habits of cleanliness and decency, instructed in useful arts, and taught the observances of truth and morality. The feeling of regard for Mr. and Mrs. Lewis, which the Natives express, notwithstanding the steady opposition offered to their superstitious observances, is in itself the strongest testimony to their consistency in well-doing.

I am also indebted for valuable aid to Mr. Shadwell of Cherra Poonjee, whose long residence in these Hills, has made him well acquainted with the Khasi language.

(*f*) I should mention, that a short primer and the Gospel according to St. Matthew, have been published in Khasi, in connexion with the Welsh Missions. These are in the Roman character, and differ in several respects from the orthography I have adopted.

system of letters, which might be advisable. For many obvious reasons, I have selected the Roman letters, consisting of the following 13 consonants: *b d g h j k l m n p r s t*, and of the vowels, *a e i o u w* and *y*, (considering *w*, as a vowel sound.) And with regard to the sounds represented by these letters, it will only be necessary to mention that they are the ordinary sounds conveyed by them on the Continent of Europe: that *g* is always hard; *h* invariably aspirate, and when it comes therefore after and with other consonants, must be sounded separately, (*ph* for example being never sounded as *f*, but as the letters *ph* in up-hill. The nasal *n* occurs (but not so frequently as in Bengali and Hindustani) and is represented by *n*; this sound is in many cases harder and harsher in tone than in those languages, and may be better expressed by *gn*.

When the vowels are accented, it is to be understood as intended to convey the grave or lengthened sound of each, *i*, for example invariably conveys the sound of *ee* in the English word feet: *e* the sound of *e*, in there. The short or unaccented *a* is intended to convey (the same sound which it is used to express in Urdu) something between the sound of *a* in America, and of *u* in but; while the letter *y* conveys the sound or nearly so, of *u* in put, or more correctly a sound between this and that of *e* in pet. The diphthongs have the same sounds as they ordinarily express in English, *eu* having however, the German sound of the same combination of vowels.

It would seem almost absurd to apply the terms ordinarily in use with reference to the inflected tongues of the Indo-European group, when we attempt to describe a language so essentially uninflected, so devoid of all those artificial variations, and so essentially simple in its construction as the Khasi. And perhaps the simplest and most correct method would be to indicate in the first instance, the general group of the root words, and then to show how these, by the simple addition of sundry prefixes or affixes, have their signification so altered, as to be respectively analogous to the several forms known in English and other inflected tongues, and called "parts of speech." And I have little doubt, that, were our knowledge of this tongue and of its relations more perfect than it is, we would be able to trace out all these variations in form or sense, and to reduce them to a few, very few, simple, and generally applicable rules.

Unfortunately this is not the case, and it will therefore be desirable to adopt in some degree the terms in ordinary use, and to apply the distinctions usually acknowledged, in the more complicated languages, of parts of speech and of their relations.

Taking these therefore in the commonly received order, we find no true *articles* in Khasi, either definite or indefinite. There are two prefixes which are invariably used before nouns, (*u* and *ka*); these indicate the gender of the noun to which they are prefixed (*u*, masculine and *ka*, feminine,) *ki* being the plural common to both genders. They also indicate, as will be seen, the number of the nouns to which they refer, and may therefore, in some sense, be considered the equivalents of articles in other tongues.

NOUNS.—Of *genders*, there are only two in Khasi, the masculine and the feminine, which are indicated by the prefixes, noted above, in the singular number: but in the plural can only be shown by the addition of *shinrung* (male) for the masculine, or of *kynthei* (female) for the feminine; (this is however very seldom done:) or by a reference to the gender in the singular.

There is no neuter gender: the names of objects, which in other languages would be considered neuter, are in Khasi preceded occasionally by the prefix *ki*, but in the singular number. This is somewhat analogous to a neuter prefix, but appears rather to indicate a *collective* sense or a doubtful or epicene gender than a true neuter. In the majority of cases, too, this prefix in this sense is used only with words adopted from other languages, such as Bengali or Hindustani. Thus a Khasi will say *ki hathi*, meaning *an elephant*, but as far as I have been able to trace this expression, I believe he would intend to convey by this, one of the elephant kind, without reference to, or, as it were, from an ignorance of any distinction in gender.*

There is no inflexion whatever in nouns; no change for the singular or plural; no declension; the sense conveyed in other languages by the various cases is here attained by prepositions or other particles prefixed to the root words; or in many cases, the position of the word in the sentence suffices to indicate the case.

ADJECTIVES.—In Khasi the adjective or qualifying word is generally placed after the substantive to which it applies. There are no inflections either for case or number.

Adjectives are formed by the relative or adjective prefix *ba*, being placed before the root word; the ordinary prefixes (*u* and *ka*,) being also used to denote the gender and number. Thus from *rit* (a root implying diminutive size) comes *u ba rit*, or *ka ba rit*, small; from *lih* comes *u ba lih*, or *ka ba lih*, white; from *ih bha*, (compounded of *ih*, to see, to appear and *bha*, good) comes *u ba ih bha*, or *ka ba ih bha*, handsome; from *buh, rih*, (compounded of the roots *buh*, to put or to place, and *rih*, to conceal) comes *u ba* or *ka ba buh rih*, hidden or concealed.

The prefixes *u* and *ka*, are generally in a sentence placed before the adjective, as well as before the noun, as *u briu u ba kraw*, a big man, or, a man who (is) big; *ka kynthei ka ba ih bha*, a handsome woman (or a woman who looks well;) but this is not invariably the case, as *ka lung rit*, a small boat, or *ka lung ba rit*, (the latter being more correct,)

ù lùm bajerong } a high mountain,
u lum jerong, }

*ka kitab ba buh rih*, a concealed book, without the second prefix *u* or *ka*.

---

* *Ki*, used in the singular sense, is frequently a term of respect or honour. Is this analogous to the use of the plural in other languages in a somewhat similar way?

COMPARISON.—The degrees of comparison are produced by prefixing *kham* for the comparative, and *tam* or *kham tam* for the superlative, as,

| | | |
|---|---|---|
| *ba bha,* | *ba kham bha,* | *ba bha kham tam,* or *ba kham bha tam,* |
| good, | better, | best. |
| *ba kraw,* | *ba kham kraw,* | *ba kham kraw tam,* or *ba kraw kham tam,* |
| large, | larger, | largest. |
| *ba rit,* | *ba kham rit,* | *ba kham tam rit,* |
| small, | smaller, | smallest. |

A high degree, without the absolute superlative being conveyed, such as our English expression *very*, is, in Khasi, expressed by the addition or postfix *eh* (hard) to any adjective as *ba bha*, good; *ba bha eh*, very good; *ba rit*, small; *ba rit eh*, very small.

All words expressive of quality or attribute, are indifferently used adjectively or adverbially, as ka ri ba *bha* a good country; u la leh *bha*, he has done well; ka briu *bymman*, a wicked woman; ki leh *bymman*, they act *wickedly:* u brin u ba *stad*, a *wise* man; u la thoh *stad* eh, he has written *very wisely*. The last instance shows also that these words admit of degrees of comparison exactly as adjectives; the only distinction being the constant absence of the adjective prefix *ba*, when these words are used adverbially. Thus a Khasi would say *u ta u* briu u thoh *kham bha* ia ka ta ka briu. That (or the) man writes *better* than that (or the) woman.

Abstract forms of nouns are rare; they are used, however, and the means of forming them exist: compound words of this class, and of many others, are most freely and profusely formed by the Khasis in their ordinary conversation.

PRONOUNS.—The *personal* pronouns are given below in the vocabulary, and afford the only instance of any approach to inflexion, which I have traced in the language. Thus the singular of the first person is *nga*, the plural *ngi* (we): of the second person the singular is *pha*, the plural *phi* (ye); of the third person the singular is *u*, or *ka*, the plural *ki*, (they). The idea of possession is given by the prefix of the particle *jong* (of or belonging to) as *jong nga*, mine; *jong ngi*, ours; *jong u*, his; *jong ka*, hers; &c., &c. The *relatives* (who, &c.,) have been given above, *viz.*, *u ba*, *ka ba*, &c., literally *he* or *she that*. The interrogatives are *u ei*, *ka ei*, *u noh*, as *u ei u ta*, who is that? *ka ta ka ba la wan sha iing, ka ei* (literally), that (female) who has gone into the house who (is she)?

Whose (relative) is therefore *jong u* or *jong ka*; whose (interrogative) will be *jong u ei* or *jong ka ei* as whose bird is this? *ka neh ka sim ka jong ka ei.* The *demonstratives* are u ta, that; ka ta that (fem:) u neh, this; kaneh, this (fem:) from the above are formed by re-dupli-

cation (as in Latin quis quis, &c.,) uno-uno-ruh, (masculine) kano-kano-ruh (feminine) whosoever; kaei-kaei-ruh, whatsoever; and the adverbial kumno-kumno-ruh, howsoever.

The prefixes *u* and *ka*, and *ki* plural, are invariably used with the pronouns to distinguish their gender, in the same manner as with substantives.

NUMERALS.—The Khasi system of numeration is very simple, and proceeds by decades. The cardinals extend from one to ten, from ten they proceed again through another decade up to 20, beginning with *kad wei*, (more one) or eleven, *kad ar* (more two) or 12, *kad la* more three, or 13, &c., &c., up to 20, which is *ar pheu* two-ten or two decades, or 20; thence they proceed in a similar way, as *arpheu wei* 21, *arpheu ar* 22, &c., to 30, which is *lai pheu* three-ten, or 3 decades, *sau pheu* four-ten or 4 decades, or 40. In precisely a similar way all the numbers up to one hundred are formed, 100 is in Khasi *shispah* (*shi* being the form of *wei, one,* used in composition,) or one hundred, hence we have *laispah* 300, *sanspah* 500, *kyndai spah* 900, *shipeu spah,* ten hundred or 1,000. But the Khasi tongue has no term for a thousand, the word hazar, pronounced by the Khasis hajar, being borrowed from the Hindustani.

The *ordinals* are formed from the cardinals by the addition of *sin,* or *wat,* as follows:—

| | |
|---|---|
| *wei* (in composition *shi*) one, | *shi sin* first, |
| *ar* two, | *ar sin* second, |
| *san* five, | *san sin* fifth, |
| *phra pheu* eighty, | *phra pheu sin* eightieth, |
| *ar spah* two hundred, | *ar spah sin* two-hundredth. |

VERBS.—The verbs are the principal root words of the language. They are for the most part monosyllabic, or unisyllabic, and I have no doubt that a more extended acquaintance with the language and its structure would show, that they were invariably so, whenever they express a simple or radical idea.

These root words undergo no change of form, and no inflexion, either for tense or mood, number or person.

MOODS.—The *indicative* is the simple root form. The imperative* is formed by prefixing the particle *to,* as from the root *rykhie* laugh, comes *to rykhie* laugh!

„ „ „ *leit* go „ *to leit,* or phin leit, or ai un leit.

---

* For the imperative "come" *alle* is more commonly used than *to wan,* as *alle hangneh,* come here: although *to wan* is also correct, and is used, as, *to wan hangneh,* come here. Similarly "go" is commonly expressed in Khasi, by *khi* (literally *stir yourself,* arouse,) as *khi noh,* go away, the regular verb *leit,* to go, being frequently, or indeed generally, used with it, as *khi leit sha lum,* go to the mountain: *to leit* without *khi* is also commonly used, *khi* appearing to give an intensitive force to the command.

The *infinitive* is formed by the prefix *ban*, as *ban rykhie*, to laugh; *ban leh*, to do; *ban thoh*, to write.

To express time, the Khasis use but few distinctive forms. For the present, the simple form of the root verb is employed, as *nga thoh*, I write; *u thoh*, he writes; *ki thoh*, they write For the idea of past time, the verb *lah*, or *la* (complete, fulfil,) is used as an adjunct or auxiliary, as *u la leh*, he has done, or he did; *me la thoh*, thou hast written; and a somewhat similar idea of time to that conveyed by the English pluperfect tense, is obtained in Khasi by a re-duplication of this particle *la*, or by the addition to *la* of *lah*, as *u la lah thoh*, he had written; *ki la lah leh*, they had done, &c., &c.

The future tense is conveyed by the simple addition of the sound of *'n* to the nominative, as *nga 'n thoh*, I will write; *u'n leit sha iing*, he will go to the house; *ki'n thoh ia ka ta*, they will write that.

These are the only true tenses or times admitted in the Khasi; but by the prefixing of sundry other words, the several distinctions of time, which are requisite for accurate description, are readily obtained. In this manner, a progressive force in the present and past times is obtained by prefixing the particle *dang*, still, yet, as *u dang deh*, he still drinks or is drinking; *u la dang deh*, he was drinking, or he still drank; *nga dang bam*, I am still eating. Similarly, the idea of being about to do, or on the point of doing, as connected with the future time, is conveyed simply by putting the particle *sa* (about to, or on the point of,) between the nominative and the verb, as *nga 'n sa wan*, I am on the point of going; *ki'n sa thoh*, they are about to write.

VOICES.—The active forms of the verbs have occasionally a passive signification conferred on them by the omission of the nominative, as *u la thoh*, with the nominative is, he has written, without the nominative (*la thoh*,) it signifies, it was written. In this form the *'n* or rather the sound of *'n*, is expressed in full as *yn*, as *u'n thoh*, he shall write (with the nominative) *yn thoh*, shall be written, (without a nominative.)

PARTICLES.—The principal particles are given in the Vocabulary; and are there divided for convenience into the several groups of adverbs, prepositions, &c., &c., although, as I have already remarked, there is but very little ground for dividing them in this artificial manner, many adverbs being also adjectives, prepositions and conjunctions; or to express it more accurately most root words being used indifferently as adjectives, as adverbs, conjunctions, &c., &c., according to the structure of the sentence. And it would, therefore, be more just to view them all as particles, expressive of certain qualifications or relations in time, place, quantity, and which are by simple prefixes and affixes rendered applicable in many different ways. To give an instance of this, *dun* is a root word expressive of the general idea of being behind either in place or time: hence we have *hadun* (*ha* in and *dun*) adverb, after; (an adverb of time) *hadun* preposition, after: (*shadun*) (*sha* to and *dun*) behind, backwards, (an

adverb of place.) From *shiwa,* before, adverb of time, (from *shiwa* first?) we have *sha shiwa* before or forwards, an adverb of place.

In the valuable paper by Mr. Robinson, to which I have alluded before (Journal of Asiatic Society of Bengal, April 1849,) it is stated that the Khasis use a large number of insignificant particles. As far as I could ascertain, this is an entirely erroneous idea. The particles are undoubtedly very numerous, and occur very frequently in the colloquial use of the language; but they appear to be used in all cases for a definite purpose, and to convey peculiar shades of meaning, or slight differences in time or other relations. Besides this frequent use of particles, the very varied and remarkable intonations of voice used freely by the Khasis, and the unceasing tendency to the juxtaposition and composition (partly) of words in order to express complex ideas, render this language a peculiarly expressive one, although being without any literature, and without even any written form, it is necessarily a difficult task to render it a medium of communication, or of instruction, excepting orally.

The intonations of voice, to which I have just alluded, strike a visitor to the Khasi Hills very forcibly after a residence in the plains of Bengal. The continuous gush of sound, which rushes, with a volubility I have never heard equalled elsewhere, from the lips of a Bengali Baboo, is strongly contrasted with the short jumping guttural tones of the Khasis. The constant recurrence of half-suppressed, half-uttered chest-tones, and the frequent elevation and depression of the voice, though not unmusical, give a peculiar jerking character to the sounds, and a kind of unfinished or incompleted tone to the words, (somewhat like the sudden stopping of the vibrations of a musical string with the hand.) This gives the listener the idea, that the teeth and palate are much more used in the formation of the tones, than the lips, and that the speakers trust as much to the modulations of their voice, as to the actual tones used, for the expression of their ideas. The Khasis also in common with most half-civilized tribes are excellent pantomimists. The expressive and easy action, with which they accompanied the description of any occurrence, or the relation of any story, has often excited my admiration. In fact, after a very few weeks' residence, I could in a great degree understand their recital of such occurrences, although not a word of the language they used was intelligible.

As might be anticipated, no regular system of syntactical construction can be traced in the Khasi tongue. A few, however, of the most obvious rules, or principles observed in the construction of sentences have been gathered from the knowledge of the language already acquired, and may be stated here.

1st. The particles *u* and *ka,* are constantly used before masculine and feminine nouns, in the singular, and *ki,* in the plural, as *ka iing,* a house; *u lum,* a mountain; *ki briu* men. If the object referred to, is to be more particularly defined, or the expression to be rendered equivalent to the use of the definite article in English ta, to, or neh, demonstrative pronouns

are used, the pronominal particles u and ka, being repeated after them, as *u ta u brin*, that man: *ka neh ka iing*, this house; *ki neh ki blang*, these goats.

2nd. A noun never occurs as the immediate or direct nominative to a verb, these particles *u*, *ka*, or *ki*, agreeing in gender and number with the noun being interposed, as *u brin u thoh*, the man writes, literally, the man he writes; *ka diing ka la duh*, the tree has decayed, *ki brin ka la leit*, the men have gone.

As in other languages, where two nouns in the singular occur, united by the conjunctive particle *bad* (and), the interposed particle (pronominal) must be in the plural as *u brin bad ka brin ki la leit noh*, the man and woman (they) have gone away.

The same rules obviously apply when the relative pronominals are used; as *ki brin ki ba la leit sha lum*, the women who have gone to the mountain, *ka brin ka ba la thoh*, the woman who has written. Similarly also with collective nouns, accordingly as they express the idea of unity or plurality, the interposed particle must be either singular or plural. To this rule there is an exception, when the verb is placed before the nominative, as is not unfrequently done; the particle is then suppressed, or is in some cases placed before the verb, and suppressed before the noun.

3rd. *La*, the particle used to give a past sense with verbal roots, (see above) is sometimes used as a sign of possession, or of the genitive case, as *u la leit sha la iing*, he has gone to *his* house.* The same *la* is sometimes used for *lada* (if) apparently a simple contraction of the latter word.

4th. When singular pronouns are connected in a sentence by the copulative *bad* (and), the pronouns are again repeated before the verb, observing in this case, to use the old terms, that the first person is more worthy than the second, &c., &c., as *nga bad phi ngi 'n shong*, I and you (we) shall sit; *me bad u phi'n leit noh*, thou and he, (ye) shall go away. But if united by *ne* (or) then the plural pronoun is not interposed; but the particle *yn*, as *phi ne u yn lih ia ka ta*, either you or he will do that.

VERBS.—To express negation, the addition of 'm to the nominative case (a contraction of *em* no) is very constantly used as nga'm la thoh, I have not written,
ki'm la leit noh, they did not go away.

The particle jiu (ever, or at all,) is frequently used between the verb and the nominative case, always with the radical, or in the present tense; this addition, however, necessarily gives somewhat of a past tense, as *u'm jiu leit*, he never goes, or he never

* I have not been able to trace the reason of this application of this particle. It may possibly be a different particle from that used as an adjunct with verbal roots, but I could not trace any distinction whatever in sound.

has gone; *phi'm jiu peole*, you never read, or never have read. In consequence of this implied past sense, the particle *la*, the sign of the past time is, generally speaking, not used along with *jiu*.

The conditional sense which in inflected tongues is conveyed by a different termination or form of the root word, is in Khasi, conveyed by the particles or adjuncts, of *lah* (be able), *bit* (be fit or right), and *dei* (a duty or obligation,) as in the following—*phi lah leit mynta*, you *can* go now; *nga la lah thoh ia ka neh*, I *could* write this; *phi'n bit ban leh ia kata*, you *should* do this; *ka dei ban phin thoh*, you must write, or it is your duty to write.

It was stated above that *ban* is the sign of the infinitive (or the equivalent of the word *to*, in English) but when two verbs come immediately together in a sentence, this particle *ban* is omitted, as in like manner the word, to, is in English, as *nga dang leit thoh*, I am going to write; *nga'n leit thoh*, I will go write; *alle shong hangneh*, come (to) sit here; but when any noun (or pronoun) comes between the verbs, the particle *ban* is not suppressed, as *nga'n leit sha iing ban thoh*, I will go into the house to write, precisely as in the English sentence the word, *to*, must in this case be used also.

The immense number and peculiarly rich variety of compound words in the language, and the extreme facility with which the Khasis form them to suit the ideas they may desire to express at the moment, render the principles on which they are formed, more important than they might otherwise be.

The language, being essentially monosyllabic, all the relations of words in the construction of sentences, and in composition, depend on the juxtaposition of these monosyllables. These roots, however, when united to form compound words, *never undergo any alteration or change, being simply juxta-posed;* a few cases of elision of a letter occur, but these are exceptions.

One of the principal *classes* of compound words, is the large group of causative or causal verbs. These are very simply formed by prefixing the particle or verbal root pyn, to the root word, as in the following instances:

| | | | |
|---|---|---|---|
| *kraw,* | great. | *pyn kraw,* | to make great or magnify. |
| *long,* | to be. | *pyn long,* | to make, to be, or create. |
| *mih,* | to rise. | *pyn mih,* | „ „ rise or raise. |
| *koit,* | to be well. | *pyn koit,* | „ „ be well or heal. |
| *bam,* | to eat. | *pyn bam,* | „ „ eat. |
| *bad,* | to follow. | *pyn bad,* | to hunt. |
| *dei,* | be necessary. | *pyn dei,* | to necessitate. |
| *da,* | to cover. | *pyn da,* | to protect. |

This principle is of universal application, and the particle *pyn* may be prefixed to any root in the language, and thus form an active verb, as in the following cases with adjective (?) roots:

| | | | |
|---|---|---|---|
| *bha,* | good. | *pyn bha,* | to make good, or ameliorate. |
| *bun,* | many. | *pyn bun,* | to multiply. |
| *eh,* | hard. | *pyn eh,* | to harden. |
| *kloi,* | quick. | *pyn kloi,* | to quicken, or hasten. |
| *lih,* | white. | *pyn lih,* | to whiten. |

Another very numerous group of verbs, implying a mutual reciprocity, or sociality, or community of action, are simply formed by prefixing the particle or radical *ia** to other root-words or compound words, as

| | | | |
|---|---|---|---|
| *dih,* | to drink. | *ia dih,* | to drink together. |
| *dat,* | to strike. | *ia dat,* | to strike mutually, that is, to fight. |
| *kren,* | to talk. | *ia kren,* | to talk together, or converse. |

To these compound verbs again, when intransitive, the root *pyn* is often prefixed, to give them a causative force as

| | | | |
|---|---|---|---|
| *ia soh,* | to join. | *pyn ia soh,* | to unite. |
| *ia kloi,* | to hasten. | *pyn ia kloi,* | to cause to hasten, or to expedite. |
| *ia bein,* | to offend. | *pyn ia bein,* | to slander or libel. |

Nouns expressing agency, or the agent, form another large and important group of compound words. These are formed by prefixing the word *nong* to root-words. (This word is used in a way very similar to that in which the affix *wallah* is used in Urdu) as, from

| | | | | |
|---|---|---|---|---|
| *bit,* | to sow, | comes | *nong bit,* | a sower. |
| *bam,* | to eat, | „ | *nong bam,* | an eater. |
| *dih,* | to drink, | „ | *nong dih,* | a drinker. |
| *dah,* | to put in order, | „ | *nong dah,* | an arranger. |
| *ap,* | to watch, | „ | *nong ap,* | a watchman. |
| *ngin,* | to reckon, | „ | *nong ngin,* | a reckoner. |

* This radical or particle *ia* is also used, as will be seen on reference to the Vocabulary below, as a preposition, and is used before almost all nouns or pronouns which form the immediate objects of verbs, as *nga'n leh ia ka ta,* I will do this. It is occasionally suppressed, especially when its use would lead to a repetition, and consequent confusion, or where in other languages the accusative case or object of the verb is followed by the dative; or, in other words, where the idea conveyed by, or the action expressed by the verb, affects not only the object, but the recipient, as, I will give this book to him, *nga'n ai ka neh ka kitab ia u,* not, *ia ka kitab;* but, I will do this, *nga'n leh ia ka ta.* This similarity of the prefix for the dative and accusative cases in Khasi, becomes of greater interest, taken in connexion with the peculiar way in which it is used, or suppressed, when we compare it with the similar use, or non-use of the dative and accusative suffixes in the Bengali and Hindustani; and with the inferences which have been drawn

This word *nong* is similarly prefixed to compound words as to causal verbs or to reciprocal verbs, as from

| | | | |
|---|---|---|---|
| *pyn im,* | to redeem, comes | *nong pyn im,* | redeemer. |
| *pyn khia,* | to heal, „ | *nong pyn khia,* | a physician. |
| *ia syllok,* | to consult, „ | *nong ia syllok,* | a counsellor. |
| *ia said,* | to plead, „ | *nong ia said,* | a pleader. |

Though I have not been able to trace the existence to any great extent of abstract nouns, (as might indeed have been anticipated) in the Khasi language, they do occur, and are formed by prefixing *jing* to the root-word, as from

| | | | |
|---|---|---|---|
| *leit,* | to go, comes | *jing leit,* | a journey. |
| *bam,* | to eat, „ | *jing bam,* | food. |
| *shong,* | to sit, „ | *jing shong,* | seat. |
| *tiah,* | to sleep, „ | *jing tiah,* | bed. |
| *thoh,* | to write, „ | *jing thoh,* | writing or document. |

Compound particles are produced by the simple juxtaposition of the simple particles, as in some English words, such as without, upon, &c., thus we have in Khasi *ha lor* upon (*ha* in and *lor* above) *sha shi shiang,* across, literally *to one side,* &c. &c.

In the foregoing remarks, references are made throughout to the ordinary rules or practices of English construction, as being those most familiar to myself, and therefore most naturally occurring to my mind.

In the following Vocabulary, the short list of words uniformly used by Mr. Hodgson and given for so many of the dialects and tongues of the Indian races and of the Indian borderers, in his many valuable papers on this subject published in the "Journal of the Asiatic Society of Bengal," is taken first, for the purposes of comparison. And to this list, I have added as full a series, as during my brief stay among the Khasis, I was able to ascertain. These have been entered in English alphabetical order, as affording the greatest facilities for reference. Although I am fully aware of the many defects which occur, I think a list of some four hundred worsd, selected on no fixed system, but obtained in the ordinary progress of intercourse with the people, will enable a fair comparison of their language with others to be instituted, and thus throw much light on their origin and relations.

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from this (see Jour. of Asiat. Soc. Bengal, No. 11, 1852. Revd. W. Kay, on the connexion of the dative and accusative, &c.) The primary sense of *ia* would seem to be, as Mr. Lewis explained it, "a general idea of motion, under any condition, or in any form, or of the transmission of an action;" and thus signifying to, towards, against, unto, &c., can readily be used, as appears above, in composition, to denote a mutuality of action, or a transmission of action from one to another. The same word or root *ia,* is used by the Khasis, when any number of persons assembled together purpose to rise up and *go away* or separate *simultaneously.*

# VOCABULARY.

| | |
|---|---|
| Air, | ka suin; byneng. |
| Ant, | u dykhiu. |
| Arrow, | u knam. |
| Bird, | sím. |
| Blood, | ka swām. |
| Boat, | ka liing. |
| Bone, | ka shung. |
| Buffalo, | shinreh. |
| Cat, | miaw. |
| Cow, | ka massi. |
| Crow, | tyngab. |
| Day, | ka sngi. |
| Dog, | u kseu. (*a*) |
| Ear, | ka shkor. |
| Earth, (zamin) | ka khyndeu. |
| Egg, | ka palling. |
| Elephant, | hati, (H.) |
| Eye, | ka khymat. |
| Father, | u kypa. (*b*) |
| Fire, | ka ding. |
| Fish, | doh-kha. |
| Flower, | ka syntiu. |
| Foot, | ka slajat. |
| Goat, | blang. |
| Hair, | ka shniuh. |
| Hand, | ka k'ti. (*c*) |
| Head, | ka khleh. |
| Hog, | u sniang. |
| Horn, | ka rèng. |
| Horse, | kolai. (*d*) |
| House, | ka iing. |
| Iron, | u nar. |
| Leaf, | ka slá. |
| Light, | ka shai. |
| Man, | u briu. |
| Monkey, | shrih. |
| Moon, | u bynai. |
| Mother, | ka kyme. (*e*) |
| Mountain, | u lum. (*f*) |
| Mouth, | ktim or shintur. |
| Moschito, | ka kniang. |
| Name, | u kaiting. |
| Night, | ka miet. |
| Oil, | ka ūm-phy-niang. |
| Plantain, | ka kait. |
| River, | ka wah. |
| Road, | ka lyn-ti. |
| Salt, | ka m'luh. |
| Skin, | ka snep. |
| Sky, | ka byneng. |
| Snake, | busein. (*g*) |
| Star, | khlur. |
| Stone, | u mau. |
| Sun, | ka sngi. |
| Tiger, | u lamàn. |
| Tooth, | ka byn-niat. |
| Tree, | ka diing. |
| Village, | ka nung; shnung. |
| Water, | ka um. (*h*) |
| Yam, | |

(*a*) Compare Lepcha kushu.

(*b*) u kypa is another man's father, u pa, one's own father.

(*c*) Lepcha kùlí.

(*d*) Obviously the same in root, as the Hindi ghora.

(*e*) ka kyme is another man's mother, ka me, one's own mother.

(*f*) allied to Lepcha lole.

(*g*) Lepcha bu.

(*h*) Lepcha ung, or more correctly, umg.

| | |
|---|---|
| I, | nga. |
| Thou, | pha. |
| He, she, it, | u. |
| We, | ngi. |
| Ye, | phi. |
| They, | ki. |
| Mine, | jong-nga. |
| Thine, | jong-me. |
| His, &c., | jong-u. |
| Ours, | jong-ngi. |
| Yours, | jong-phi. |
| Theirs, | jong-ki. |
| One, | wei. |
| Two, | arh. |
| Three, | lai. |
| Four, | sau. |
| Five, | sàn. |
| Six, | hinriu. |
| Seven, | hin-ieu. |
| Eight, | phrá. |
| Nine, | khyndai. |
| Ten, | shi-pheu.* |
| Twenty, | arh-pheu. |
| Thirty, | lai-pheu. |
| Forty, | sau-pheu. |
| Fifty, | sàn-pheu. |
| Sixty, | hinriu-pheu. |
| One hundred. | shi-spah. |
| Of, | jong. |
| To, | sha. |
| From, | wa; waduh. |
| By (instrument,) | da; wa; bad. |
| With (*cum sath*, in Hindi,) | bad; lem; da. |
| Without (*sine*, *bina* in Hindi,) | khlem; habar. |
| In, on, | ha, hapoh, sha-poh. |
| Now, | mynta. |
| Then, | mynkata, mynta, hynda kumta. |
| When, | mynba; haba; ynda; hynda kumta. |
| To-day, | mynta; ka kani; ka sngi. |
| To-morrow, | la shai. |
| Yesterday, | myn hy wnin. |
| Here, | Hang-ne. |
| There, | Hangta; hangtai. |
| Where, | shane; shaei; haei. |
| Above, | ha-nong; hajerong. |
| Below, | sha-rum; ha-rum; haty-bian. |
| Between, | ha pyddeng; mar pyd-deng. |
| Without (outside,) | sha-b-ār; ha b-ār. |
| Within, | sha-poh; ha-poh. |
| Far, | jing-ngai. |
| Near, | ha-jan. |
| Little, | rit, (in size) khyndiat, (in quantity.) |
| Much, | bun; shibun; shi kaddei. |
| How much, | katno. |
| As (relative,) / So (correlative,) | kumta; kum; / kumba. katba. |
| Thus (positive,) | kumne; kat kane. |
| How, | kum-no. |
| Why, | balei; naka-balei. |
| Yes, | haoid. |
| No, | ah; wau.; em. |
| Not, | em. |
| Also, and, | ruh, de. |
| Or, | ne; lane. |
| This, | ka-ne; u-ne. |
| That, | kata; ka-tai; uta. |
| Which, (relative,) *jaun*, H. | ka-ba; ki-ba; u-ba. |
| Which, (correlative,) *taun*, H. | ditto; ditto; ditto. |
| Which, (interrogative) *kaun*, H. | |
| What, (*kya*,) | ka-ei? ainh? kumno? |

(*a*) *shi* is the form of *wei* (one) used in composition.

| | |
|---|---|
| Who, (kon,) | u-ba; ka-ba; ki-ba, mano, u-ei. |
| Anything, (kuch,) | kaei-kaei-ruh. |
| Anybody, (koi,) | iano-iano-ruh; mano-mano-ruh. |
| Eat, | bam. |
| Drink, | dih. |
| Sleep, | thiah. |
| Wake, | peit; kyndit. |
| Laugh, | ryk-hie. |
| Weep, | iam. |
| Be silent, | wat-jam. |
| Speak. | kren. |
| Come, | alle, (*a*) |
| Go, | khie-leit, (*a*) |
| Stand up. | ieng. |
| Sit down. | shong. |
| Move, (walk,) | iaid. |
| Run, | phet. |
| Give, | ai. |
| Take away, | shim-noh; rah-noh. |
| Strike, | shoh; sym-pat. |
| Kill, | pyn-iap. |
| Bring, | wallam. |
| Take away, | shim-noh. |
| Lift up, | rah-soit. |
| Hear, | sngou, (*b*) |
| Understand, | sngou-thuh; shem-phong. |
| Tell relate, | ia-thuh; by-na. |
| Good, | ba bha. |
| Bad, | „ sniu |
| | „ b'ymman. |
| Cold, | „ khreat. |
| | „ pi-jah. |
| Hot, | „ shit. |
| Raw, | „ khlem; shet. |
| | „ im. |
| Ripe, | ba ih. |
| Sweet, | „ tiang. |
| Sour, | „ jeu. |
| Bitter, | „ ky-tang. |
| | „ jeu. |
| Handsome, | „ ih-bha. |
| | „ sniu-brin. |
| Straight, | „ beit. |
| Crooked, | „ dor; kynriang. |
| Black, | „ iong. |
| White, | „ lih. |
| Red, | „ sau. |
| Green, | „ jingnam. |
| Long, | „ jerong. |
| Short, | „ lyngkot; ty-bian. |
| Tall, | „ jerong; san. |
| Small, | „ rit; ty-bian. |
| Great, | „ khrau; heh. |
| Round, | „ pyl-lun. |
| Square, | „ sau-dong, (four sides.) |
| Flat, Level, | „ lyngkin. |
| Fat, | „ sngaid; klein. |
| Thin, | „ raikha; stang. |
| Weariness, | ka ba-tait. |
| Hunger, | ka ba-thyn-gan. |
| Thirst, | ka ba-stiang. |
| Adorn, | deng. |
| Agree, | ia-kut. |
| Announce, | ia-lap. |
| Arrange, | dah. |
| Arrive, | poi. |
| Ask, | kylli. |
| Assist, | ia-rap. |
| Be, | long. |
| Beat, | dat. |
| Be happy. | ia suk. |
| Believe, | ngeit. |

(*a*) See above in Grammar.

(*b*) Is this not the same as the Hindi *sunno?*

| | |
|---|---|
| Bend, | pyn-dem; khun; pyn-dor, (*a*) |
| Be necessary, | dei. |
| Be silent, | en. |
| Be well, | koit. |
| Bind, | dem. |
| Bite, | dait. |
| Boil, | shet. |
| Break, | khein; dykut; pait. |
| Breathe, | ring-munsie im pyrsat. |
| Bud, (or blossom,) | put. |
| Build, | tei. |
| Burn, | ing; thang. |
| Burst, | byt-tei; pait. |
| Bury, | tep. |
| Buy, | thiet. |
| Call, | kot. |
| Carry, | rah; kit; bah. |
| Catch, | khem. |
| Chase, | bih. |
| Clean, (verb,) | pyn khuid. |
| Collect, | lang. |
| Come, | wan. |
| Confess, | pla. |
| Consult, | ia-syl-lok. |
| Converse, | ia-kren. |
| Cough, | hoh. |
| Cover, | dà. |
| Cry, | yàm. |
| Curse. | tìm. |
| Cut, | ot. |
| Dance, | shad-pyn-shad. |
| Decay, | duh. |
| Descend, | hier. |
| Devour, | rong. |
| Dig, | pù. |
| Discuss, | ia-said. |
| Divide, | klàd. |
| Drag, (or pull,) | ring. |
| Drink, | dih. |
| Eat, | bam. |
| Embrace, | ia-piam. |
| Ensnare, | ngat. |
| Envy, | bishni. |
| Fade, | sep. |
| Fall, | hap. |
| Fear, | ting; shepting; khaweit. |
| Find, | loàd; shem. |
| Fish, | khwai-doh-kha. |
| Float, | ki. |
| Fly, | her. |
| Follow, | bàd. |
| Forbid, | a dong. |
| Forget, | klet. |
| Friend, | lok. |
| Gape, | ang. |
| Get free, | lait. |
| Give, | ai. |
| Go, | leit; khie. |
| Grow, | mi. |
| Hammer, | shoh. |
| Hasten, | ia-kloi, (neut.) pyn-kloi, (act.) |
| Hate, | isi. |
| Have, | ioh. |
| Heal, | pyn-khia; pyn-koit. |
| Heat, | pyn-shai; ryhem. |
| Hear, | sngow. |
| Hunt, | beh; mhràd. |
| Howl, | jileu. |
| Join, | ia-soh; pyn-dait; pyn-bytteng. |
| Jump, | noh; ryng-kang. |
| Kill, | pyn-iap. |
| Kiss, | ia doh. |
| Laugh, | rykhaie. |
| Learn, | hi kai; byttah. |
| Lose, | iah. |
| Love, | ieit. |
| Marry, | shong-ku-rim. |

(*a*) *khun*, to bend down ; *pyn-dem*, to lay down flat ; *pyndor*, to bend aside.

| | |
|---|---|
| Meet, | ia-shem. |
| Melt, | sain; pyn-um. |
| Mix, | khleh. |
| Offend, | ia-bein. |
| Open, | plie. |
| Perjure, | smai-lam-lēr. |
| Pierce, | pei. |
| Plead, | ia-said. |
| Press, | shon-bàn. |
| Pull, | ring. |
| Put, (or place,) | buh. |
| Prosper, | man. |
| Prune, | ngor. |
| Read, | pule. |
| Reckon, | ngiu. |
| Redeem, | pyn-im. |
| Ride, | shong-kolai. (*a*) |
| Rise, | ieng. |
| Run, | phet. |
| Ruffle, | ran. |
| Say, | ong. |
| See, | ioh ih, khymih, jing oh. |
| Seek, | pan. |
| Sell, | die. |
| Send, | pha. |
| Set in order, or arrange, | dah. |
| Shave, | khih. |
| Shine, | shai. |
| Shoot, | siăt. |
| Shut, | khang. |
| Sing, | ru-wai. |
| Sink, | ngam. |
| Sit, | shong. |
| Stand, | ieng. |
| Sow, | bet. |
| Speak, | kren. |
| Spit, | bla. |
| Steal, | tuh. |
| Step, (or walk slowly,) | jàm. |
| Strike, | dat; shoh. |
| Swear, | smai. |
| Sweep, | sar. |
| Swim, | jingih. |
| Take, | shim. |
| Talk, | kren. |
| Thank, | nguh. |
| Think, | mut; puson; pyrkhàt. |
| Turn, | kylla. |
| Walk, | iaid. |
| Wash, | sait. |
| Watch, | ap. |
| Weep, | iam. |
| Work, | leh. |
| Write, | thoh. |
| | |
| Age, | ka karta. |
| Arm, | ka pung k'ti, (lower.) |
| | ka sang k'ti, (upper arm,) |
| Ass, | gudda, (H.) |
| Bag, | ka byrni. |
| Basket, | ka shang; ka ja-pe. |
| Bed, | kă l'ti. |
| Beginning, | ka ba-sydang: myn-myn-kong. |
| Behind, | ha deeing. |
| Betel-nut, | u knai. |
| Blue, | ba lih-byrthup. |
| | „ iong-byrthup. |
| Book, | ka kitap (H.) (*b*) |
| Boy, | u khyn-nah. |
| Bow, | ka rynti. |
| Box, | ka sundūk, (H.) |
| Bread, | u kypu. |
| Brick, | ka dow thong, (clay burn.) |

(*a*) Literally, sit horse.

(*b*) This is the Hindustani word adopted. The Khasi tongue has no word for book, it being a thing unknown to them; kitap is only known to those who have had intercourse with the Bengalees or Europeans. It is always sounded as spelt above, *kitap*, not kitab.

| | |
|---|---|
| Bride, | ka nong leit kurim, (the woman who goes to marry.) |
| Broad, | ba iàr; ba kyl-luid. |
| Brother, | u para. |
| Butter, | ka mukhun, (H.) |
| Cane, | u thri. |
| Centipede, | u ktiar. |
| Chair, | ka chowki, (H.) |
| Charcoal, | u rynga. |
| Child, | u or ka khynnah, |
| Circle, | jing-thaio-wiar: ly-wai. |
| Clay, | ka dow. |
| Clean, | ba khuid. |
| Cloth, | ka jair. |
| Clouds, | u lyoh. |
| Coal, | ka dow-iong, (black clay.) |
| Cobweb, | ka snur thab-ba-wa. |
| Copper, | ka taman, (H.) |
| Cotton, | u kun-pah. |
| Cough, | u hoh. |
| Cousin, | para ka. |
| Crow, | tyng àb. |
| Custom, | ka niam; ka rukm (H.) |
| Dark, | bà dūm. |
| Deaf, | ba kyllut. |
| Dear, | „ bythong. |
| Deity, | u, or ka, blei. |
| Demon, | u ksui. |
| Different, | ba phèr; ba kyrpḥang. |
| Dirty, | ba khlià. |
| Door, | ka jing-khang. |
| Duck, | ka hàn. |
| Earing, | tili-ush shkor. |
| East, | sho-mih-ngi. (*a*) |
| Elbow, | ka tung-briit. |
| End, | ka ba-kut. |
| Enemy, | u, or ka, ba-shùn; ba-isi. |
| Enough, | bi-ang. |
| Evening, | |
| Eternity, | b'ym-jiu-kut. (*b*) b'ym-jiu-iap. (*c*) |
| Eye-brow, | ka ier-mat. |
| Few, | khyn-diat. |
| Fingers, | ki hinna-k'ti. |
| Fishing-line, | u ksai-khwai. |
| Fool, | u or ka ba-biet. |
| Foolish, | ba-biet. |
| Fore-head, | ka shyllang-mat. |
| Fowl, | siar. |
| Friend, | lòk. |
| Fruit, | soh. (*d*) |
| Garden, | ka ky-pèr. |
| Girl, | ky khynnah. |
| Glass, | ka iit. |
| Grass, | u phlang. |
| Gold, | ka ksier. (*e*) |
| Gun, | ka sulai. (*f*) |
| Gun-powder, | u buk-hor. |
| Hair, | u shniuh. |
| Hammer, | ka tyr-nem. |
| Hateful, | ba isi. |
| Hard, | u eh. |
| Hatred, | ka ba-shūn; ba bishni. |
| Heart, | u klong. |
| High, | ba jerong. |
| Hire, | ka by-wai. |
| Hook, (fishing,) | u khwai. |
| Honey, | ka ngap. (*g*) u lwai. |
| Hour, | buji. (H.) |

(*a*) Literally, *towards the growing day.*
(*b*) Never ending.
(*c*) Never dying.
(*d*) Obviously the same as the Sontal *joh.*
(*e*) Compare Lepcha jere.
(*f*) That form of gun or small cannon which is fixed in the ground.
(*g*) *Ka ngap*, honey with the comb; *u lwai*, honey without the comb.

House, ka iing.
Husband, u tyngá.
Ice, u thah.
Infant, khunlung.
Interest, (for money,) ka sùt.
Ink, ka siah, (H.)
Iron, u nàr.
Jack-fruit, u soh-ṗàn.
Kind, ba isnei.
Kite, (a bird,) khling.
Kite, (a play thing,) kakot kùdi.
Knife, ka tari.
Land, ka khyn-deu.
Lamp, ka sharak.
Law, ka hūkm, (H.)
Lead, ka sisa, (H.)
Leg, ka kyjàt.
Leopard, khlà.
Liberty, ka ba lait, (*a*)
„ ba-leh-ih-mon.
Lime, ka shùn, (H.)
Limestone, u maw-shùn.
Liver,
Love,
Lungs, u tùr.
Male, (sex,) shinrang.
Many, bun: shi-bun.
Magnetic iron-sand, maw-pūr-sūt.
Map, ka dùr.
Market, ka ieu.
Master, u kynrad; trai, (*b*)
Mat, ka shilliah.
Measure, ka jing-theu.
Meat, ka dòh.
Middle, ka pyddeng.
Milk, ka dùdh, (H.)
Money, ka sybai.
Mortar, (cement,) sùrki, (H.)
Mouse, (red,) nels-sah.
Mule, khachar, (H.)
Nail, (of fingers,) ka tyr-sim.
Narrow, ba klm.
Native, u trai-ri.
Neck, ka ryndang.
Needle, u thyr-nia.
Nephew, u kunrue, (paternal.)
„ părsa, (maternal.)
New, ba thymmai.
North, sha-tei.
Nose, ka khy mùt.
Oath, ka jing smai.
Old, ba tymmen.
Orange, u soh-ngiam-tra.
Other, ka wei pat.
Ox, u massi dàp.
Quiver, ka rung-kap.
Paun, ka tèm-pow.
Paper, ka kot.
Pen, ka kolom, (H.)
Pine-apple, u soh-trun.
Pond, ka pung.
Potato, u ṗlan, (*c*)
Power, (or force,) ka bor.
Prayer, ka jing-duwai.
„ jing-kyr-pad.
Price, ka dorh.
Pride, ka jing leh krau.
„ jing-sngow ryngbah.
Priest, u lyng-doh.
Rain, u sl-āp.
Rat, khnai.
Rice, u kau. (*d*)
Root, u, or ki tied.
Round, pyllu.

---

(*a*) ka ba lait, liberty as compared with slavery; ka ba-leh-ih-mon, liberty to take, to have, &c.
(*b*) u kynrad, *sahib*, u trai, *lord*.
(*c*) Properly any fruit or tuber which grows under ground.
(*d*) *Ja*, is boiled rice, and is also used metaphorically, for "meals," "daily food."

| | |
|---|---|
| Rupee, | ka tynka. |
| Same, | juh : kum-juh. |
| Sand, | u shiap. |
| Servant, | shakri. |
| Sheep, | lang-brot. |
| Shield, | ka stih. |
| Shot, | ki goli, (H.) |
| Shoulder, | ka tyrpeng. |
| Silk, | u ksai rusom. |
| Silver, | ka rùpa (H.) |
| Sister, | ka para. |
| Sky, | ka byneng. |
| Slave, | mrau. |
| Slavery, | ka jing-long mrau. |
| Smoke, | ka tydèm. |
| Snow, | ka ior. (*a*) |
| South, | sha-thi. |
| Spider, | thab-ba-wa. |
| Spirits, (sharāb, H.) | ka kiad. |
| Spoon, | ka siang. |
| Spring, (of water,) | ka um-poh-liu. |
| Square, | ba sau-dong, (four sides,) |
| Steam, | ka tydēm ūm. |
| Steel. | ka syrti. |
| Straw, (or grass,) | u phlang. |
| Sword, | ka wait-lam. |
| Table, | ka miej, (H.) |
| Tea, | ka sha, (H.) (*b*) |
| Tears, | ki ūm-mat; or, ūm-khy-mat. |
| Thread, (or rope,) | u ksai. |
| Time, | ka aiom. |
| Tobacco, | ka dhumà-slah. (*c*) |
| Umbrella, | ka shattri (H.) |
| Uncle, | u kasan, (paternal.) |
| Uncle, | u ky-ni, (maternal.) |
| Uneven, | ka ba them, ka-ba-àt (*d*) |
| Valley, | ka tēm. |
| Vulture, | puk-ni. |
| Waist, | ka sung kai. |
| Walking-stick, | un diing-duh. |
| Watch, | ka bajji, (H.) |
| Week, | ka shi tai eu. |
| Well, | ka pokhri. |
| West, | sha-sep-ngi. (*e*) |
| Whip, | u diing synpat. (*f*) |
| Wicked, | ba b'ymman. |
| Wife, | ka tyn-ga. |
| Wind, | ka lyèr. |
| Window, | ka jing-khang-iit. |
| Wise, | ba stàd. |
| Wood, | ka diing. |
| Wool, | u shniuh-lang-brot. |
| Woman, | ka kynthei. |
| Year, | ka snem. |
| Yellow, | ba stém. |
| Young, | ba khynrau. |
| | ba samla. |
| Youth, | u, or ka ba-samla. |
| Father-in-law, | u k'thaw. |
| Mother-in-law, | ka kiau or ka syng-keu-kurim. |
| Daughter-in-law, | ka-pyrsa-kurim. |
| Brother-in-law, | u kynūm. |

The following are the principal prepositions, conjunctions, &c., in the Khasi tongue, together with their force in English; and the mode of using them in sentences.

---

(*a*) This word for snow is now unknown to the people about Cherra Poonjee, where snow never falls, although still known to the Khasis in the higher parts of the hills; a curious instance of the gradual dying out of a language from a change in the physical circumstances under which those using it are placed.

(*b*) Only known to those who have mixed with Europeans.

(*c*) "Smoke leaf."

(*d*) "Upwards, downwards."

(*e*) Literally—"towards the fading day."

(*f*) "A stick to beat."

Sha—into; towards; to; in the direction of; used after words expressing motion, as ki la leit sha lùm they have gone *to* the mountain—occasionally not expressed, as ki la leit iing—they have gone *to* the house.

Ha—in; into; at; used after words expressing existence or place, as he is *in* the house, u don *ha* iing.

Ia—this particle is used before all nouns or pronouns, which are the objects of verbs in a sentence, (vide page lix.)

Ia—to; for; against; or contrary to; as in the sense, he fought against the enemy. (*a*)

Da—by; with; by means of; in the sense of with in English, when it expresses the instruments or means by which an act is done, as he struck him *with* his hand, u la dat ia u *da* la ka k'ti.

Na—from, any place or object, as opposed to *sha*—used in compound words also as *nalor* from above, *na pyddeng*, from the middle of.

Bad—with, together with, in company of—as *alle* bad nga, come *with* me. (*b*)

Bad—also; and; used between the words it connects.

| | |
|---|---|
| Jong, | of; belonging to. |
| Ha lor, | on, upon. |
| Ha poh, | under, within. |
| Ha pyddeng, | in the middle of; among; between. |
| Ha kymat, | in presence of; before. |
| Ha jan, | near to. |
| Sha shi-liang, | to one side, across. |
| Sha-pang, | concerning, respecting, regarding. |
| Sha bàr, | out of. |
| Ruh, | *also, and.* |
| Ti, | then. |
| Di, | as well as; also; too. |

These are most frequently used at the end of a sentence; occasionally between the nominative and verb; but never at the beginning of a sentence.

| | |
|---|---|
| Lymda, | either; except. |
| Lymne, | neither. |
| Ne, | or. |
| La-ne, | nor. |
| Hin rei. | but. |
| Ba, | that. |
| Tam, | than. |
| Kam, | as, so. |
| Na mar, | for; because of; on account of. |
| Na mar kata, | therefore. |
| Na ka bynta, | for the sake of. |
| Na ka ba kumnoh? | wherefore? |
| Na ka ba lei? | why. |
| Te, | then. |
| Ta dynda, | until. |
| Kadba, | as long as. |
| | so long as. |
| Mynba, | when. |
| La noh? | when? |
| La da, | if, unless. |
| La ka ta, | although. |
| Baroh-ar, | both. |
| Mynta, | now. |
| Myn-dang, | just now. |
| Myn-y-neh, | awhile ago. |
| Myn ariu, | formerly. |
| Jing mynta, | latterly. |
| Myn-hy-nin, | yesterday. |
| Ba-mynta, | to-day. |
| La shibit, | soon, bye and bye. |
| La wei, | hereafter. |
| La noh, | when; at what time. |
| La shai, | to-morrow. |
| Shiwa, | before. |
| Ha-diin, | after. |

(*a*) Or, more simply, he fought the enemy.

(*b*) Literally—"Come also I."

| | |
|---|---|
| Pat, | again. |
| Tang, | yet, still. |
| Ha-ba-ka-sngi, | daily. |
| Ha ba dei ba dei, | sometimes, seldom. |
| Hangnei, | here. |
| Hang-tai, | there. |
| Hang noh, | whence. |
| Hang ta, | thence. |
| Sha diin, | behind, (in place.) |
| Sha shiwa, | before, forward, (in place.) |
| Jing ai, | far. |
| Sha noh, | whither, where. |
| Sha lor, | above. |
| Sha poh, | below. |
| Khei no, | enough. |
| Ha boi, | yes! |
| Shisha, | truly, verily. |
| Em, | no! |
| Num, | not. |
| Um shah. | not at all. |
| Wat, | not: used with the imperative form of verbs. (*a*) |

The connexion of the Khasi tongue with the dialects of the tribes living to the East of their territory, and through these with the Siamese and, generally, with the Indo-Chinese borderers, having been already to a certain extent recognized, I will conclude by simply mentioning a few examples, (the number of which might be readily increased) of the analogy existing between the Khasi vocables, and those of the Thibetan and Indo-Thibetan tribes. I have above indicated the similarity of a few Khasi words with Lepcha words of the same signification, and the following are additional instances of this affinity with the Thibetan group of dialects.

Cat, *Khasi* miau, *Gyami* myau.
Dog, *Khasi* kseu, *Manyak* kshah, *Horpa* katah.
Father, *Khasi* pa; kypa *Horpa*, *Tákpa*, *Manyak* ápá, *Gyarung* ta-pè.
Mother, *Khasi* me: kyme, *Gyami* ma.
I, *Khasi* nga, *Gyami* gno, *Gyarung*; *Horpa*, gna, *Tákpa* gne: nye.
One, *Khasi* shi, *Takpa* thi.
Of, (Poss:) *Khasi* yong: compare the dang of the *Horpa* and the yong of the *Gyarung*. Mr. Hodgson, (*b*) (to whose valuable Sifan and Horsok vocabularies, I am indebted for the above vocables) doubts the genuineness of the disjunct series of possessives said to exist in the *Gyarung* dialect, and formed by the suffix *yong*. But the existence and regular use of the precisely similar series in Khasi, formed by the prefix, jong, is undoubted. The only difference is, that in Khasi the possessive particle is prefixed; in *Gyarung* it is suffixed.

Many other similar instances might be added, but one or two will suffice at present, hoping at some future time to trace out these relations more in detail.

Come, *Khasi* alle, *Gyami* le.
Sleep, *Khasi* thiah, *Manyak* khaiyah.
Run, *Khasi* phet, *Takpa* pshet.

(*a*) This is obviously the same word as *mat* in Hindi.
(*b*) Journal Asiatic Society Bengal, No. 2, 1853, page 145.

# NOTES.

LIMESTONE, pages 27 to 31.—Many months subsequently to the submission of my Report, in November, 1853, I was favored by Lieutenant Cave, of Cherra Poonjee, with a brief, but very interesting account of a tour made by him across the Jynteeah Hills, during the cold season of 1853-54. He says "there is some fine scenery in parts, but, considering the tract of country I went over, the objects of attraction were few, and when they were found, there were several collected together within a short distance of each other. I went down to the Kopili River, but unfortunately I hit it at an uninteresting place, and the numerous tiger foot-prints along the banks, prevented my exploring far. I saw enough, however, to assure me that there must be something to see in its course. Not far from the Kopili is a lovely stream, full of beauty; every hundred yards presenting a new and perfect picture of a character different from any that I am acquainted with in the hills, but not unlike some of the streams in Wales, but on a larger scale, and with greater luxuriance of vegetation. The forests in that locality are very interesting, they are not so full of underwood as you would expect, or as you are accustomed to see in other parts. The clearings of the Kookies," (Kukis) "and Meekirs, are very like, what I should imagine the back-wood settlements of America to be. We did not know that we had any Kookies within our districts. They are very nice people, and I think preferable to Cossyahs" (Khasis). "They bear an excellent character from the Cossyahs who visit them to trade for Cotton. The Meekirs are a good set too; but even the Cossyahs in that out-of-the-way place are more primitive in their habits, than those in our neighbourhood" (near Cherra Poonjee).

"The limestone extends far into the hills to the Eastward, and I am inclined to think that it runs quite into Assam, but I did not quite ascertain that point, as I could not go down to the plain at that side. At one place called Nungclai, the limestone is very peculiarly placed. I do not mean geologically, but pictorially. The valley is about one mile broad, flat-bottomed, and surrounded by low hills. All round the valley at the bottom of the hills, are walls of limestone, presenting a more perfect resemblance to buildings than anything of the kind I have before seen. On closer inspection, these walls are curious, being composed of huge rectangular masses, regularly divided into streets, which cross and re-cross each other at right angles or nearly so, and extend some distance. These streets are of a good width, six or eight feet; sometimes a fine tree is growing up from the bottom, and generally there are branches and creepers arching over the top, all very picturesque. I was very much disappointed at the ill-behaviour of my surveying compass which got rid of all its magnetic power, and I was therefore unable to get in any of these places. Since my return, I have got a theodolite, and I hope to be able to do something towards mapping the country. But to return to the limestone; this Nungclai Poonjee is sloping towards Assam, I mean the water-shed is in that direction. I think the largest bed of limestone in the hills, lies to the East of Lakadong. In the map of Jynteeahpore" (Lieutenant Cave refers to the Revenue Survey Map by Captain Thuillier) "on the East you see the River Loorba with its long straight reach in the hills. (*a*) About a mile or so above the point marked Morallee Poonjee, the limestone begins, and reaches all the way to Nungclai, and even North of it some five miles, but whether farther to the North, I do not know."

"It is strange that this stone in the Loorba should have escaped notice. Several people have gone up searching for stone, but they have always turned back just before reaching the proper spot. There is water-carriage the whole way, and the rock is quite into the water." "The distance is against the lime being very profitably worked."

Lieutenant Cave concludes his interesting account by some notices of the beautiful scenery he met with, which his skill as a draughtsman, enabled him to appreciate warmly. It is greatly to be wished that his activity and energy and his power of observation, might be more systematically devoted to the examination of the hills among which he has been so long engaged in other ways. There is still a large field for

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(*a*) This stream, the Loorbha, is marked on Plate B, passing by Molagodhaut, Northwards, but is not named.

discovery along the face, and up the gorges of these hills, in places which can only be visited during the cold season.

Page 53.—It would appear by the very interesting account of the life of the Honorable Robert Lindesay while in India ("Lives of the Lindesays," vol. iii, p. 149,) that if he were not the first to commence the working of lime, in the Sylhet district, (and it would seem that the trade was known and established even before his arrival), he was probably the first European who devoted any attention to it. This was at least 20 years prior to the close of the last century, since which time there has been a steady increase in the traffic.

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I have in several places in my report used the term ("current-marking") which I have been for many years in the habit of employing to express that peculiar structure ordinarily called "ripple-marking." This latter term is decidedly erroneous, the structure, as has been often remarked, not being the mark of a ripple, but rather a ripple itself. Current-marking is less objectionable, although the marks left by currents are so numerous, and of such various kinds, that it is scarcely definite enough. "Rippling" would probably be the simplest and best term, although even this will, to many, convey the idea of water being the only agent to produce such appearances. That this is not the case, the most cursory examination of a sandy beach, or of the dry sands of a river-bed, will convince any one. In fact, this peculiar structure is as frequently produced by the action of wind, as by that of water; and may often be seen as perfectly marked in the dappled clouds of the sky, as on the sea shore. It is simply the result of the continuous passage of a fluid over materials, whose physical texture admits of free motion among their particles; this passage or current of the fluid, being only of such strength or rapidity as to drive, shove, or impel these particles forward without maintaining them in suspension. Rippling ceases to occur when either the size of the particles moved or the force of the current, is so altered, as to alter the mode of progression of these particles. Any one, who will attentively examine the motion of the dry sand of the sea-shore, or of a river-bed, will see, that in all cases when this wavy surface is developed, the particles of the sand are regularly forced up the long and wind-ward or current-ward slope of the ripple, and reaching the top, fall by their own gravity down the steep or leeward side: the same process being again repeated with succeeding particles, so that the entire upper surface of the sand is in slow and continuous motion. A sudden increase of the force of the wind or current, such as a sudden blast, will obliterate all this wavy appearance, precisely as it would obliterate the regular and continuous waving or rippling of the surface of water; and on the wind re-assuming its normal force, this waving will be again re-produced.